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RESEARCH LETTER

Periprocedural and Short-Term Outcomes of Percutaneous Left Atrial Appendage Closure According to Type of Atrial Fibrillation

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Percutaneous left atrial appendage closure (LAAC) with the Watchman device (Boston Scientific) has emerged as an alternative to anticoagulation for stroke prevention in patients with atrial fibrillation (AF).[1] AF generally starts as paroxysmal AF in nature, and progresses to persistent or permanent AF. A greater electrical burden of nonparoxysmal AF than paroxysmal AF is associated with a larger size and a decreased function of the left atrium.[2] These features of nonparoxysmal AF may increase the procedural complication risk of LAAC. In addition, since nonparoxysmal AF carries a higher thromboembolic risk than paroxysmal AF among patients receiving anticoagulation,[3] nonparoxysmal AF may also pose a higher thromboembolic risk than paroxysmal AF among patients undergoing LAAC. However, it remains unclear whether the effectiveness of LAAC differs among AF types. We hypothesized that patients with nonparoxysmal AF had a higher risk of periprocedural and short-term events following LAAC than patients with paroxysmal AF. Therefore, we sought to compare the periprocedural and short-term outcomes of LAAC according to AF type, using a US population-based database.

This study was exempted from the approval of the institutional review board because it used anonymized and de-identified data in a publicly available database.

The present study is a retrospective analysis using the Nationwide Readmissions Database 2016 to 2017, a publicly available administrative claims database released by the Healthcare Cost and Utilization Project.[4] The Nationwide Readmissions Database allows capturing of any readmission in a state until the end of December in a calendar year. The *International Classification of Diseases, Tenth Revision* (*ICD-10*) codes were used to identify patients ≥18 years of age with a primary diagnosis of AF (I48.0/I48.1/I48.2) who underwent percutaneous LAAC (02L73DK). Eligible patients were grouped into patients with paroxysmal AF (I48.0) or nonparoxysmal AF (I48.1/I48.2, including persistent, long-standing persistent, and permanent/chronic AF). The primary outcome was the in-hospital composite outcome, defined as death, ischemic stroke/transient ischemic attack, systemic embolism, bleeding requiring blood transfusion, pericardial effusion/cardiac tamponade treated with pericardiocentesis or surgically, and removal of embolized device. The secondary outcomes were the individual components of the composite outcome and 180-day readmission outcomes (any-cause readmission and ischemic stroke/transient ischemic attack). For the present analyses, we used unweighted data in the Nationwide Readmissions Database and compared

Key Words: complication ■ left atrial appendage closure ■ paroxysmal atrial fibrillation ■ persistent atrial fibrillation ■ stroke

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Table. Patient Characteristics and In-Hospital and 180-Day Outcomes of Percutaneous Left Atrial Appendage Closure in Patients With Paroxysmal Versus Nonparoxysmal Atrial Fibrillation

	Unmatched cohort			Propensity score–matched cohort		
	Paroxysmal atrial fibrillation (n=3694)	Nonparoxysmal atrial fibrillation (n=4130)	Absolute standardized difference, %*	Paroxysmal atrial fibrillation (n=3290)	Nonparoxysmal atrial fibrillation (n=3290)	Absolute standardized difference, %*
Patient characteristics						
Age (y) mean±SD	75.4±8.0	76.6±7.9	16.4	75.9±7.7	76.0±8.1	1.0
Women	1705 (46.2)	1439 (34.8)	23.2	1348 (41.0)	1350 (41.0)	0.1
CHA2DS2-VASc score, mean±SD	4.1±1.5	4.2±1.5	3.2	4.1±1.5	4.1±1.5	0.7
Prior percutaneous coronary intervention	568 (15.4)	650 (15.7)	1.0	512 (15.6)	516 (15.7)	0.3
Prior coronary artery bypass grafting	530 (14.3)	643 (15.6)	3.4	480 (15.0)	508 (15.4)	2.4
Prior valve implantation	188 (5.1)	253 (6.1)	4.5	177 (5.4)	178 (5.4)	0.1
Prior pacemaker/defibrillator implantation	929 (25.1)	1089 (26.4)	2.8	849 (25.8)	868 (26.4)	1.3
Prior cerebrovascular disease	947 (25.6)	978 (23.7)	4.5	813 (24.7)	802 (24.4)	0.8
Mitral regurgitation	235 (6.4)	325 (7.9)	5.9	216 (6.6)	225 (6.8)	1.1
Tricuspid regurgitation	72 (1.9)	112 (2.7)	5.1	70 (2.1)	69 (2.1)	0.2
Pulmonary hypertension	176 (4.8)	335 (8.1)	13.7	176 (5.3)	179 (5.4)	0.4
Carotid artery disease	94 (2.5)	78 (1.9)	4.5	73 (2.2)	71 (2.2)	0.4
Chronic pulmonary disease	701 (19.0)	829 (20.1)	2.8	624 (19.0)	651 (19.8)	2.1
Renal failure	670 (18.1)	884 (21.4)	8.2	628 (19.1)	645 (19.6)	1.3
Liver disease	87 (2.4)	118 (2.9)	3.2	81 (2.5)	88 (2.7)	1.3
Malignancy	83 (2.2)	107 (2.6)	2.2	81 (2.5)	77 (2.3)	0.8
Anemia	517 (14.0)	605 (14.6)	1.9	447 (13.6)	462 (14.0)	1.3
Obesity	521 (14.1)	627 (15.2)	3.0	468 (14.2)	471 (14.3)	0.3
Hospital status						
Metropolitan teaching hospital	3184 (86.2)	3568 (86.4)	0.6	2845 (86.5)	2845 (86.5)	0.0
Annual hospital procedural volume*						
Lowest tertile (≤28 cases/y)	1301 (35.2)	1487 (36.0)	1.6	1163 (35.3)	1178 (35.8)	1.0
Middle tertile (29–57 cases/y)	1130 (30.6)	1355 (32.8)	4.8	1029 (31.3)	1044 (31.7)	1.0
Highest tertile (≥58 cases/y)	1263 (34.2)	1288 (31.2)	6.4	1098 (33.4)	1068 (32.5)	1.9
In-hospital outcomes			***P* value†**			***P* value†**
Composite outcome of the following events	87 (2.4)	96 (2.3)	0.94	78 (2.4)	69 (2.1)	0.45
Death	≤10 (≤0.3)‡	≤10 (≤0.2)‡	1.00	≤10 (≤0.3)‡	≤10 (≤0.3)‡	1.00
Ischemic stroke/transient ischemic attack	18 (0.5)	21 (0.5)	1.00	17 (0.5)	16 (0.5)	1.00
Bleeding requiring blood transfusion	21 (0.6)	22 (0.5)	0.88	17 (0.5)	14 (0.4)	0.72
Pericardial effusion/cardiac tamponade treated with pericardiocentesis or surgically	39 (1.1)	36 (0.9)	0.42	35 (1.1)	27 (0.8)	0.37
Removal of embolized device	≤10 (≤0.3)‡	13 (0.3)	0.67	≤10 (≤0.3)‡	≤10 (≤0.3)‡	0.65
Length of stay ≥2 d	528 (14.3)	564 (13.7)	0.43	465 (14.1)	442 (13.4)	0.43

(*Continued*)

Table. Continued

180-d readmission after discharge§	(n=1491)	(n=1680)	*P* value‖	(n=1351)§	(n=1351)§	*P* value‖
Any-cause readmission	407 (27.3)	475 (28.3)	0.57	373 (27.6)	368 (27.2)	0.86
Ischemic stroke/transient ischemic attack¶	22 (1.5)	22 (1.3)	0.69	19 (1.4)	19 (1.4)	1.00

Values are n (%) unless otherwise indicated. Propensity scores were estimated using a multivariable logistic regression model including all patient characteristics as covariates. Propensity score matching was performed at a ratio of 1:1 using the nearest-neighbor method without replacement with a caliper within 0.1 times the pooled SD of the logit of the propensity scores. An absolute standardized difference of <10% indicates no meaningful difference between the 2 groups.

*Defined as the annual number of percutaneous left atrial appendage closure cases in each hospital in each year.

†Fisher exact test.

‡Categorical variable cell with n≤10 was suppressed in compliance with the policy of the Healthcare Cost and Utilization Project Data Use Agreement.[4]

§Includes only patients discharged alive before July in each year to allow for 180-day follow-up after discharge in the Nationwide Readmissions Database.[4] To compare 180-day readmission outcomes between the groups, propensity score matching using only 3171 patients discharged alive before July in each year created 1351 pairs in which all patient characteristics were well-balanced.

‖Log-rank test. Patients were censored if they died during readmission without stroke/transient ischemic attack.

¶Ischemic stroke/ transient ischemic attack after discharge was identified using data on diagnoses recorded during readmissions.

patient characteristics and outcomes between the groups using a propensity score matching.

Of 7824 eligible patients, 3694 (47.2%) had paroxysmal AF and 4130 (52.8%) had nonparoxysmal AF (Table). In the unmatched cohort, patients with nonparoxysmal AF, as compared with those with paroxysmal AF, were older, more often male, and had a higher prevalence of pulmonary hypertension. CHA_2DS_2-VASc score did not differ significantly between the 2 groups. Propensity score matching created 3290 pairs, in whom patient characteristics were well balanced. In the propensity score–matched cohort, there were no significant differences in the in-hospital composite outcome (2.4% versus 2.1%, *P*=0.45) and its components between the paroxysmal AF and nonparoxysmal AF. Furthermore, there were also no significant differences between the groups in terms of 180-day any-cause readmission (27.6% versus 27.2%, log-rank *P*=0.86) and 180-day ischemic stroke/transient ischemic attack (1.4% versus 1.4%, log-rank *P*=1.00) (Table). In subgroup comparisons of persistent (I48.1, n=1828) versus permanent/chronic AF (I48.2, n=2302), there were no significant differences in the composite outcome (2.1% versus 2.5%, *P*=0.41) and 180-day ischemic stroke/transient ischemic attack (1.3% versus 1.3%, log-rank *P*=0.964).

Despite significant differences in age and sex, there was no significant difference in CHA_2DS_2-VASc score between the paroxysmal AF and nonparoxysmal AF groups. This finding suggests that LAAC is performed in patients with AF with high CHA_2DS_2-VASc score regardless of AF type. Importantly, our propensity score–matched analysis did not find any statistically significant association between AF type and in-hospital and 180-day adverse outcomes following LAAC. Given that approximately half of the candidates for LAAC have nonparoxysmal AF,[1] this finding appears to be clinically meaningful with respect to periprocedural and short-term risk management following LAAC among patients with different AF types. Meanwhile, a recent study revealed that patients with long-standing persistent AF, as compared with those with non-long-standing persistent AF, had a higher incidence of moderate peridevice leak (3–5 mm) at 6 weeks following LAAC (27% versus 4%; *P*=0.008) despite the similar moderate peridevice leak immediately postimplant (2% versus 0%; *P*=0.14).[5] This finding suggests that peridevice leak may occur at a later phase among patients with nonparoxysmal AF. The peridevice leak might be associated with future thrombus formation in left atrium. Therefore, further studies are warranted to understand the impact of AF type on long-term outcomes following LAAC.

The present study has several limitations related to the data source. The Nationwide Readmissions Database lacks data on bleeding risk score, laboratory/imaging findings, details of LAAC procedure, peridevice leak, pre-/post-LAAC antithrombotic therapy (anticoagulant/antiplatelet), and long-term follow-up. Nonetheless, the present study provides an insight into the application of LAAC in patients with different AF types. Our analyses did not find any significant difference in procedural safety and short-term effectiveness between patients with paroxysmal AF or nonparoxysmal AF, implying LAAC as a safe, effective therapeutic option regardless of AF type. Further studies are warranted to examine the differences in long-term effectiveness of LAAC according to AF type.

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