Advanced Interatrial Block Predicts Atrial Fibrillation Post Cavotricuspid Isthmus Ablation for Typical Atrial Flutter

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Abstract. Introduction*: A significant proportion of patients develop atrial fibrillation (AF) following cavo-tricuspid isthmus (CTI) ablation for typical atrial flutter (AFl). The aim of this study was to assess whether advanced interatrial block (aIAB) is associated with new AF after CTI ablation in patients with typical AFl and no prior history of AF.* ***Methods:*** *Patients with typical AFl and no prior history of AF referred for CTI ablation were included. A post-ablation ECG in sinus rhythm was evaluated for the presence of aIAB: p-wave ≥ 120 ms and biphasic morphology in inferior leads. New-onset AF was identified from 12-lead ECGs, Holter monitoring and device interrogations.* ***Results:*** *The cohort consisted of 122 patients; age 67±10.6 years, 79.5% male, left atrial diameter 42.8±6 mm, ejection fraction 55.8±11.2%. aIAB was detected in 23% of the patients. Over a mean follow-up was 30.5±15.3 months, 57 patients developed new-onset AF (46.7%). The incidence of AF was greater in patients with aIAB (71.4%) compared to those without aIAB (39.4%, p=0.003). After multivariate analysis, aIAB remained statistically significant (OR 2.9, 95% CI 1.02-8.6; p<0.04).****Conclusion:*** *Advanced IAB is a predictor of new-onset AF after successful CTI ablation in patients with typical AFl and no prior history of AF.*

Keywords: Interatrial block; atrial flutter; atrial fibrillation

1. Introduction

Catheter ablation of the cavo-tricuspid isthmus (CTI) is an established and curative first-line therapy for patients with typical atrial flutter (AFl) with success rates exceeding 90%. However, a significant proportion of successfully ablated patients will develop atrial fibrillation (AF) during follow-up (1,2).

Interatrial block (IAB), a delay of conduction over the Bachmann bundle, is manifested in the 12-lead electrocardiogram (ECG) by a P-wave duration > 120 ms either with biphasic [±] morphology in the inferior leads (advanced IAB) or without it (partial IAB) (3). Advanced IAB (aIAB) is frequently associated with atrial tachyarrhythmias and has been found to be a predictor of AF in many different clinical scenarios (4).

2. Methods

The retrospective cohort was selected from all patients admitted to Kingston General Hospital for catheter ablation of typical AFl from 2008 to 2011. Inclusion criteria were: (i) paroxysmal or persistent typical AFl and no prior history of AF, (ii) post-ablation 12-lead ECG available and (iii) successful catheter ablation defined by the demonstration of bidirectional conduction block over the isthmus.

A post ablation 12-lead electrocardiogram (ECG) in sinus rhythm was evaluated for the presence of IAB. P-wave duration was measured using semi-automatic calipers. Partial IAB

(pIAB) was defined as a p-wave ≥ 120 ms and aIAB was defined as a p-wave ≥ 120 ms accompanied by a biphasic morphology (±) in the inferior leads (Figure 1).

Catheter ablation was performed using a maximum voltage guided approach. An 8-mm large tip or a 4-mm irrigated catheter was used.

Episodes of new-onset AF were identified from 12-lead ECGs, Holter monitoring and device interrogations. In addition, any extra ECGs, Holter monitoring or event recorders driven by patient's symptoms were also considered.

Data were expressed as means and standard deviations for continuous variables, and frequencies and percentages for categorical variables. Following univariate comparisons, a multivariate logistic regression analysis was performed to identity predictors of AF. P values < 0.05 were considered statistically significant

3. Results

A total of 122 patients were included. Baseline characteristics are summarized in Table 1. The mean follow-up was 30.5 ± 15.3 months.

Table 1. Baseline characteristics. LA = left atrium; LVEF = left ventricular ejection fraction; IAB = interatrial block

Variable	Mean ± SD or %
Age, years	67 ± 10.6
Male sex	79.5
Hypertension	55.7
Diabetes	25.4
Prior stroke	4.9
Ischemic heart disease	32.0
Sleep apnea	23.0
CHADS2 score	1.3 ± 1.1
LA dimension, mm	42.8 ± 6
LVEF, % ± SD	55.8 ± 11.2
P-wave duration, ms	138.9 ± 20.3
IAB	
- Advanced	22.9
- Partial	58.2

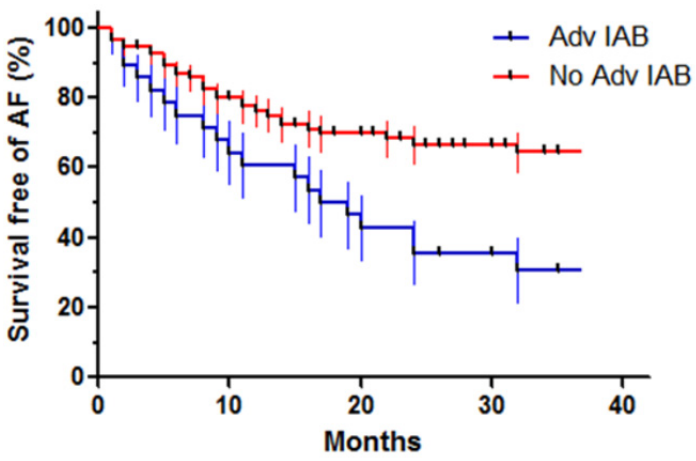

Fig. 1. Survival free of AF in patients with and without aIAB

At the moment of the electrophysiology study, 68 patients were in atrial flutter (55.7%) whereas 54 were in sinus rhythm (44.3%) and thus received an empiric CTI ablation. aIAB was detected in 28 patients (22.9%), pIAB in 71 (58.2%), and p-wave duration was normal in 23 patients (18.9%). The mean p-wave duration was 138.9 ± 20.3 ms.

At the end of the follow-up, 57 patients had displayed at least one episode of AF (46.7%). Of these, 16% (n = 9) presented early after the procedure (within 3 months)

and 56% (n = 32) occurred within the first 12 months. In patients with aIAB the incidence of AF was 71.4% compared to 39.4% in those without aIAB (p=0.003) (Figure 1). Table 2 shows the clinical characteristics of patients who developed AF compared with those who did not. aIAB was a powerful predictor of AF development after a successful AFl ablation (OR 2.9, 95% CI 1.02-8.6; p<0.04) (Table 3) after controlling for ischemic heart disease, LA dimension and LVEF, none of which were significant in the final model.

4. Discussion

AF is commonly observed after ablation of typical AFl and thus the optimal duration of anticoagulation in successfully ablated flutter patients is unknown. Previous history of AF is the strongest predictor of post-ablation AF (2) and therefore it is reasonable that patients with pre-ablation AF anticoagulation should be continued according to their estimated embolic risk. However, the approach in patients with typical AFl but no previous documented AF is less clear. In this group, clinical predictors of AF have not been consistently demonstrated and a follow-up monitoring strategy has not been well-defined.

Table 2. Clinical variables in patients with and without atrial fibrillation. AF = atrial fibrillation; LA = left atrium; LVEF = left ventricular ejection fraction; IAB = interatrial block.

Clinical variable	No AF (n = 65)	AF (n = 57)	p
Age, years ± SD	65.5 ± 11.9	68.5 ± 8.7	0.115
Male sex	80.0%	78.9%	0.886
Hypertension	53.8%	57.9%	0.653
Prior stroke	6.2%	3.5%	0.500
Ischemic heart disease	24.6%	40.4%	0.063
CHADS2 score	1.4 ± 1.2	1.2 ± 1.0	0.494
LA dimension, mm	41.7 ± 6.2	44.0 ± 5.8	0.074
LVEF, % ± SD	57.6 ± 9.8	53.8 ± 12.4	0.086
Advanced IAB	12.3%	35.1%	0.003
P-wave duration, ms	136.5 ± 21.3	141.7 ± 19.0	0.164

Table 3. Predictors of atrial fibrillation on multivariate analysis

Clinical variable	Odds ratio	95% Confidence Interval	p value
Ischemic heart disease	1.83	0.70 - 4.79	0.22
LA dimension	1.04	0.96 - 1.13	0.28
LVEF	0.99	0.95 - 1.04	0.81
Advanced IAB	**2.98**	**1.03 - 8.63**	**0.04**

In this study, almost half of the patients developed AF after a mean follow-up of 30.5 ± 15.3 months; most of them within the first post-ablation year. This observation is in keeping with previous studies which have reported the development of new-onset AF in ≥50% patients with isolated typical AFl after a follow-up period of 2-3 years (5).

The presence of aIAB was a strong predictor of new-onset AF post-ablation as the association remained significant in a multivariate analysis. Whilst there was a trend for the LA size to be an average of 2.3 mm larger in patients that developed AF this did not reach statistical significance. The association of IAB with atrial arrhythmias was first described by Bayés de Luna et al. (6), who reported a high incidence of paroxysmal supraventricular tachycardias (50% AF) in 16 patients with aIAB at 30-month follow-up (93.7% vs. 27.7% in controls; p < 0.001). IAB has also been associated with AF recurrence after electrical cardioversion (7), after pulmonary vein isolation (8) and with progression of paroxysmal AF to persistent or permanent AF (9,10). The mechanism of this association is not completely understood,

however there is some speculation on the pathophysiology. The biphasic p-wave morphology in the inferior leads reflects predominant caudo-cranial activation of the LA through the coronary sinus. Such conduction had previously been demonstrated by Puech in 1954 using a combination of surface ECG and esophageal leads (11). More recently Puech's observations were confirmed using endocardial mapping (12). This delayed and heterogeneous electrical activation of the LA results in impaired LA mechanical function, interatrial dyssynchrony and increased susceptibility to AF

5. Conclusions

In conclusion, aIAB in a surface 12-lead ECG is an independent predictor of the occurrence of AF after successful CTI ablation in patients with typical AFl and no prior history of AF. These findings may help guide decisions regarding the maintenance of anticoagulation after AFl ablation.

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