Relationship between the $CHADS_2$ score and risk of very late recurrences after catheter ablation of paroxysmal atrial fibrillation

Tze-Fan Chao, MD,*†‡ Kibos Ambrose, MD,* Hsuan-Ming Tsao, MD,†§ Yenn-Jiang Lin, MD,*† Shih-Lin Chang, MD,*† Li-Wei Lo, MD,*† Yu-Feng Hu, MD,*† Ta-Chuan Tuan, MD,*†‡ Kazuyoshi Suenari, MD,*‖ Cheng-Hung Li, MD,*† Beny Hartono, MD,* Hung-Yu Chang, MD,¶ Tsu-Juey Wu, MD,†# Shih-Ann Chen, MD*†

*From the *Division of Cardiology, Department of Medicine, Taipei Veterans General Hospital, Taipei, Taiwan, †Institute of Clinical Medicine and Cardiovascular Research Center, National Yang-Ming University, Taipei, Taiwan, ‡Division of Cardiology, Taipei Municipal Gan-Dau Hospital, Taipei, Taiwan, §Division of Cardiology, National Yang Ming University Hospital, I-Lan, Taiwan, ‖Department of Cardiovascular Medicine, Hiroshima University Graduate School of Biomedical Sciences, Hiroshima, Japan, ¶Division of Cardiology, Department of Medicine, Cheng Hsin General Hospital, Taipei, Taiwan, and #School of Medicine, Chung-Shan Medical University, Taichung, Taiwan.*

BACKGROUND Catheter ablation of paroxysmal atrial fibrillation has been performed for more than 10 years. However, data about the long-term results were limited.

OBJECTIVES To evaluate the long-tem efficacy following paroxysmal atrial fibrillation ablation and to investigate whether there were different patterns of recurrences in patients with different $CHADS_2$ scores.

METHODS A total of 238 patients with paroxysmal atrial fibrillation who received a catheter ablation from 2004 to 2007 were enrolled. Free of recurrence was defined as the absence of atrial arrhythmias without using any antiarrhythmic agents after ablation.

RESULTS There were 121 patients (50.8%) suffering from recurrences after the first ablation procedure during a median follow-up period of 5 years. The $CHADS_2$ score and left atrial diameter were significant predictors of recurrences in the multivariate analysis. Different patterns of recurrence were observed in different groups of patients categorized on the base of $CHADS_2$ score. Among patients with a $CHADS_2$ score of ≥ 3 without recurrences at 2 years postablation, 63.6% experienced episodes of arrhythmias during the subsequent follow-up period. In contrast, in patients with a $CHADS_2$ score of 0 without recurrences at 2 years postablation, the future recurrence rate was only 2.7%.

CONCLUSIONS After a successful ablation, recurrences may continue to occur without reaching a plateau during the long-term follow-up, especially in patients with a high $CHADS_2$ score. The optimal follow-up strategy may differ and should be individualized for patients with different scores.

KEYWORDS Paroxysmal atrial fibrillation; Catheter ablation; Long-term outcome; Recurrence

ABBREVIATIONS **AF** = atrial fibrillation; **LA** = left atrium; **PAF** = paroxysmal AF; **PV** = pulmonary vein

(Heart Rhythm 2012;9:1185–1191)

Background

Catheter ablation targeting the pulmonary veins (PVs) has been reported to be a potential method for treating atrial fibrillation (AF) since the late 1990s.[1,2] As the techniques and technologies have improved, catheter ablation of AF has become the standard and an effective therapy for patients with symptomatic and drug-refractory AF and its popularity continues to escalate.[3] Although a number of studies reported the recurrence rates after catheter ablation of paroxysmal AF (PAF), the follow-up duration was relatively short. The data about the efficacy of catheter ablations and how to identify patients who are at risk of recurrences after a long-term follow-up are very important, because it may change the strategy for the follow-up frequency, methods, and even decisions in regard to the use of warfarin after the ablation procedure. Therefore, the goals of the present study were (1) to evaluate the long-tem outcome following PAF ablation and (2) to investigate whether there were different patterns of recurrences in patients with different $CHADS_2$ scores, which were proven to be associated with different recurrence rates after ablation.[4]

Dr Chao and Dr Ambrose contributed equally to this study. **Address for reprint requests and correspondence:** Dr Shih-Ann Chen, MD, Division of Cardiology, Department of Medicine, Taipei Veterans General Hospital, No. 201, Sec. 2, Shih-Pai Road, Taipei, Taiwan. E-mail address: epsachen@ms41.hinet.net.

1547-5271/$ -see front matter http://dx.doi.org/10.1016/j.hrthm.2012.03.007

Methods

Study population

A total of 277 patients with symptomatic drug refractory PAF who received radiofrequency catheter ablation for the first time under the guidance of a NavX mapping system (NavX; St Jude Medical, Inc, St Paul, MN) from 2004 to 2007 were included. Those who did not receive regular follow-up for at least 2 years after the ablation (39 patients) were excluded. Finally, there were 238 patients enrolled in the present study.

Catheter ablation of PAF

The details have been described in our previous work.[5–7] In brief, each patient underwent an electrophysiological study and catheter ablation in the fasting, nonsedative state after written informed consent was obtained. All antiarrhythmic drugs except for amiodarone were discontinued for about 5 half-lives before the procedure. After a successful transseptal procedure, a 3-dimensional geometry of the left atrium (LA) was created by dragging a 4-mm tip deflectable catheter (EPT catheter; Boston Scientific, Inc, Boston, MA) or a cooled-tip catheter (Chilli II, Boston Scientific) around the endocardial surface of the LA by using the NavX contact mapping system. The PV ostia were identified by fluoroscopy and marked on the 3-dimensional map of the LA. Thereafter, a PV isolation with continuous circumferential lesions was created by encircling the right and left PV ostia guided by the NavX system. The intention was to place the radiofrequency lesions at least 1–2 cm away from the angiographically defined ostia. Successful circumferential PV isolation was demonstrated by the absence of or dissociated PV activity. Entrance and exit block were confirmed with the use of the circular catheter (Spiral; AF Division, St Jude Medical, Inc). After successful isolation of all 4 PVs, an AF inducibility test was performed with repeated high current (3–5 times the pacing threshold) and wide pulse duration (8 ms) stimulation from the proximal and distal coronary sinus (in 10-ms decrements from 250 to 150 ms, with a duration of each pacing cycle length of 5–10 seconds). If AF was induced, an additional linear ablation was performed at the anterior roof guided by the NavX system, followed by the mitral isthmus if AF still persisted (linear ablation was not performed anymore for patients with PAF after 2009). If AF was terminated during the linear ablation, the linear line was completed and AF induction was attempted again. If the AF did not stop or was still inducible after roof and mitral line ablations, sinus rhythm was restored by electrical cardioversion. In addition to PV isolation and the linear ablation, the ablation was applied to non-PV ectopy that intiated AF. The methods of the identification and definition of the non-PV trigger have been described in our previous publications.[8,9] In brief, we tried to find spontaneous ectopic beats initiating AF before or after the infusion of isoproterenol (1–4 μg/min). If the ectopy did not occur spontaneously, short bursts of rapid right atrial pacing with brief intermittent pauses between bursts were performed. Whenever AF was terminated (either by the catheter ablation or by cardioversion) and reinitiated during the procedure, the beats that initiated AF were carefully located. The ablation was performed in the area with the earliest electrical activity or a local unipolar QS (presence of 1 large negative deflection) pattern of the ectopic beats preceding the AF.

Postablation follow-up

After the catheter ablation, oral amiodarone was prescribed for 8 weeks to prevent any early recurrence of AF. If patients could not tolerate amiodarone, propafenone or flecainide was used in those patients. Patients underwent regular follow-up (2 weeks after the catheter ablation, and then every 1–3 months) at our cardiology clinic or with the referring physicians, where routine electrocardiogram was performed at each visit. During the follow-up period, patients were intended to receive a 24-hour Holter monitoring or 1-week cardiac event recording every 3 months. Besides, when the patients experienced symptoms suggestive of a tachycardia after the ablation, a 24-hour Holter monitoring and/or cardiac event recording for 1 week were performed

Table 1 Baseline characteristics of the patients (n = 238)

Variables	Study population (n = 238)
Age (y), mean ± SD	53.2 ± 12.8
Age > 75 y, %	5
Sex: Man, %	71.4
Underlying diseases, %	
Hypertension	53.8
Diabetes mellitus	18.1
Congestive heart failure	7.6
Coronary artery disease	11.3
Previous stroke/transient ischemic attack	6.7
$CHADS_2$ score, %	
0	45.4
1–2	42
≥ 3	12.6
Number of AADs used before ablation, median (interquartile range)	2 (1–3)
Baseline AADs before catheter ablation, %	
Amiodarione	29.8
Propafenone	24.4
Flecainide	7.1
AADs after catheter ablation, %	
Amiodarone	92.4
Propafenone	4.2
Flecainide	3.4
Body mass index (kg/m^2), mean ± SD	25.1 ± 3.3
Transthoracic echocardiogram	
LA diameter, mm	38.3 ± 5.9
LA diameter >40 mm, %	36.6
LVEF, %	54.5 ± 6.7
AF duration (y), mean ± SD	5.8 ± 3.9
Catheter ablation procedure, %	
Presence of non-PV trigger	11.8
Additional linear ablation	22.7

AF = atrial fibrillation; AADs = antiarrhythmic drugs; LA = left atrium; LVEF = left ventricular ejection fraction; PV = pulmonary vein.