Atrial fibrillation (AF) is the most common arrhythmia. It is associated with a decreased quality of life, increased hospitalizations, and a 2-fold increased risk of death. Perhaps most importantly, the risk of a thromboembolic (TE) event in patients with AF is increased 5-fold (1-3).

Multiple schema have been proposed to risk stratify patients with AF for TE events. A simple risk assessment scheme is the CHADS2 score (4), which evolved from the Stroke Prevention in AF (SPAF) investigators criteria, and is the primary basis for guiding antithrombotic therapy in the American College of Cardiology/American Heart Association (ACC/AHA) AF guidelines (2). More recently, the CHA2DS2-VASc score was described (5). This scoring system provides an increased emphasis on age >75 years and includes the additional risk factors of vascular disease and female gender. The CHA2DS2-VASc score improves the predictive value for TE events in patients with AF (5,6). Both the CHADS2 and CHA2DS2-VASc scores were validated as predictors of TE events in patients with AF who were treated pharmacologically for rate and/or rhythm control. Importantly, and perhaps under-recognized, these studies demonstrate that the CHA2DS2-VASc score can identify the patients with a CHADS2 score of 0 or 1 who have an increased risk of a TE event. That is, CHA2DS2-VASc can identify the low-risk CHADS2 patient who is actually high risk for a TE event (5,6).

Catheter ablation is a standard treatment for patients with drug-refractory, symptomatic AF (2). Although the modalities and approaches to catheter ablation of AF differ between centers, left atrial (LA) ablation with pulmonary vein isolation is generally a cornerstone to this therapy. The success rate of catheter ablation varies according to the pattern and duration of AF, the LA size, and LA substrate, and is approximately 70% (7). The major complication rate associated with catheter ablation of AF is 3% to 5%, and is generally related to vascular access, although there is a small risk of a TE event and death (7,8). TE events immediately after catheter ablation of AF are thought to be related to thrombus formation on the trans-septal sheaths and catheters, or to char and thrombus formation at the ablation sites. TE events remote from the ablation procedure may be due to decreases in LA transport after catheter ablation of AF or to the intrinsic risk of TE events in patients with AF (9).

There have been several attempts to quantify and predict TE events and death rates in patients undergoing catheter ablation of AF. Oral et al. (10) studied 755 consecutive patients undergoing catheter ablation of AF. All patients were placed on oral anticoagulation for 3 months after the procedure. A TE event occurred in 1.1% of patients, with the majority of events occurring within the first two weeks. A worldwide survey of 20,825 catheter ablation procedures for AF reported a TE event rate of 1.0% and a death rate of 0.15% (7). In a recent study, 232 consecutive patients underwent brain magnetic resonance imaging after catheter ablation of AF. The symptomatic TE rate was 0.4%, and the rate of silent TE events was 14% (11). These studies were unable to demonstrate clinical predictors of TE events or death in patients undergoing catheter ablation of AF. In addition, the findings of a transesophageal echocardiogram (TEE), with the exception of a LA thrombus, do not predict the patient at risk for a TE event after catheter ablation of AF (12).

In this issue of the Journal, Chao et al. (13) provide some data that help predict who is at risk for a TE event after catheter ablation of AF. The authors evaluate the usefulness of the CHADS2 and CHA2DS2-VASc scores to predict the risk of TE events and death in patients undergoing catheter ablation of AF. A total of 565 patients, of whom 440 had paroxysmal AF, were enrolled in the study and followed for a mean of 39.2 months. Before catheter ablation of AF, oral anticoagulation therapy was based on the patient’s CHADS2 score. A TEE was performed on all patients prior to catheter ablation of AF in order to exclude the presence of a LA thrombus. Catheter ablation of AF was performed in a standard fashion with 2 circumferential sets of lesions around the right and left pulmonary vein (PV) ostia with confirmation of PV isolation, using either a conventional
4-mm-tip or irrigated-tip catheter. Additional linear ablation
sets in the LA and coronary sinus were performed based
on the persistence or inducibility of AF after PV
isolation. After catheter ablation of AF, warfarin was
administered for at least 3 months to those patients who
were receiving it before ablation. The decision to discon-
tinue warfarin after ablation was individualized and based
on physician preference. Clinical follow-up occurred every 1
to 3 months after catheter ablation of AF, with adverse
events and deaths evaluated by chart review, telephone
consultations, and review of the National Death Registry of
Taiwan.

The combined endpoint of adverse events included isch-
emic stroke, transient ischemic attack (TIA), peripheral
embolism, pulmonary embolism, and death. Overall, 27
(4.8%) adverse events occurred, including 9 deaths, 9
ischemic strokes, 6 TIAs, 1 peripheral embolus, and 2
pulmonary emboli. Baseline CHADS2 and CHA2DS2-
VASc scores were calculated. The predictive accuracy of
each score, as well as the optimal cutoff values to predict
adverse events was identified using receiver-operator char-
acteristic curves. Univariate analysis demonstrated that older
age, hypertension, congestive heart failure, coronary artery
disease, previous TE event, larger LA diameter, and persis-
tent AF were associated with adverse events. Multivariate
analysis demonstrated that the only independent predictors
of adverse events were the CHADS2 and CHA2DS2-VASc
scores.

Therefore, the authors conclude that the CHADS2 and
CHA2DS2-VASc scores may be useful for predicting ad-
verse events after catheter ablation of AF. A linear relation-
ship between the CHADS2 and CHA2DS2-VASc scores,
and the rate of adverse events was observed. Using a cutoff
value of 2 for both the CHADS2 and CHA2DS2-VASc
scores, there was a significant difference in event rates in
patients undergoing catheter ablation of AF with CHADS2
scores >2 or <2 (15.2% vs. 2.4%), as well as in patients with
CHA2DS2-VASc scores >2 or <2 (11.1% vs. 1.1%). However,
the most striking finding in this study was seen among the
460 patients with a CHADS2 score of 0 or 1. There were 11
(2.4%) adverse events in this group. Among these 460
patients, 98 (21%) had a CHA2DS2-VASc score of >2. The adverse
event rate of the 362 patients with a CHADS2 score of
0 or 1 and a CHA2DS2-VASc score of <2 was 1.1%, whereas
the adverse event rate among the 98 patients with a
CHA2DS2 score of 0 or 1 and a CHA2DS2-VASc score of >2
was 7.1%. These data demonstrate the improved sensitivity
of the CHA2DS2-VASc scoring system.

The authors point out at least 2 important limitations
of this study. First, the use of anticoagulation therapy was not
standardized, and low-risk patients may not have received
oral anticoagulation therapy for the first 3 months after
catheter ablation of AF. Generally, oral anticoagulation
therapy is recommended for at least the first 3 months after
catheter ablation of AF, regardless of the baseline risk of a
TE event. This may explain the relatively high rate of TE
events in this study. Second, this was an observational study
with nonuniform follow-up.

Overall, the authors should be congratulated for their
successful effort in identifying a method to predict which
patients undergoing catheter ablation of AF may be at
increased risk for TE events and death. The CHA2DS2-
VASc score has been incorporated into the European
Society of Cardiology 2010 AF guidelines, but is not
mentioned in the AHA/ACC 2011 update to the 2006 AF
guidelines (1,2,14). Perhaps this is why healthcare providers
in the United States mainly utilize the CHADS2 risk
stratification scoring system to help guide antithrombotic
therapy in patients with AF. For patients with AF and
CHADS2 scores >2, oral anticoagulation therapy is clearly
superior to aspirin in prevention of TE events (1,2). How-
ever, for patients with AF and a CHADS2 score of 0 or 1,
the CHA2DS2-VASc score may help to identify the “low
risk” patient at “high risk” for a TE event. The data from
Chao et al. (13) may allow us to identify the patient who is
at high risk for a TE event, but has a hanging CHAD.

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REFERENCES

of atrial fibrillation: the Task Force for the Management of Atrial
Fibrillation of the European Society of Cardiology (ESC). Europace
guidelines for the management of patients with atrial fibrillation—
executive summary: a report of the American College of Cardiology/
American Heart Association Task Force on Practice Guidelines and
the European Society of Cardiology Committee for Practice Guide-
lines (Writing Committee to Revise the 2001 Guidelines for the
Management of Patients With Atrial Fibrillation). J Am Coll Cardiol
3. Pryorowski EN, Camm J, Lip GY, et al. The impact of new and
emerging clinical data on treatment strategies for atrial fibrillation.
5. Lip GY, Nieuwlaat R, Pisters R, et al. Refining clinical risk stratifi-
cation for predicting stroke and thromboembolism in atrial fibrillation
using a novel risk factor-based approach: the Euro heart survey on
6. Olesen JB, Fauchier L, Lane DA, et al. Risk factors for stroke and
thromboembolism in relation to age amongst patients with atrial fibrillation: the Loire Valley Atrial Fibrillation Project. Chest 2011 Jun
7. Cappato R, Calkins H, Chen SA, et al. Updated worldwide survey on
the methods, efficacy, and safety of catheter ablation for human atrial
circumferential ablation for atrial fibrillation on left atrial transport


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