Transesophageal Echocardiographic Screening before Atrial Flutter Ablation: Is It Necessary for Patient Safety?

Daniel Alyeshmerni, MD, Altaf Pirmohamed, MD, Ana Barac, MD, PhD, John Smirniotopoulos, BS, Eric Xue, MS, Steven Goldstein, MD, Jay Mazel, MD, and Joseph Lindsay, MD, *Washington, District of Columbia*

Background: Transesophageal echocardiography (TEE) is commonly used before atrial flutter (AFl) ablation to detect atrial thrombus (AT) and thereby identify a heightened risk for systemic embolism both in patients with their initial episodes of AFl and in those with prior episodes whose anticoagulation has been inadequate. This treatment strategy has been extrapolated from guidelines for atrial fibrillation. In fact, limited data exist regarding the prevalence or clinical associations of AT and spontaneous echocardiographic contrast (SEC) in patients with AFl. Both AT and SEC are believed to represent risk factors for systemic embolization. This study was designed to provide further insight into the prevalence of these and their associated clinical findings.

Methods: The results of transesophageal echocardiographic examinations in 347 consecutive patients with AFl in whom radiofrequency ablation procedures were planned were reviewed. In each case, specific care was taken to identify AT and SEC. The presence of either AT or more than mild SEC was considered to reflect a thrombogenic milieu (TM). Clinical and echocardiographic data were analyzed to determine the frequency and relevant clinical associations of these two markers of increased thromboembolic risk. In addition to determining the prevalence of AT and TM, the study sought to identify predictors of their presence short of TEE that might allow that procedure to be avoided.

Results: AT were found in 19 of the 347 patients (5.4%). TM was present in 39 patients (11.2%). SEC was associated with reduced left atrial appendage emptying velocity ($P < .001$). History of myocardial infarction ($P = .02$) was associated with AT. Reduced left ventricular ejection fraction ($P = .01$), reduced left atrial appendage emptying velocity ($P < .001$), diabetes mellitus ($P = .02$), congestive heart failure ($P = .04$), and chronic renal insufficiency ($P = .05$) were associated with a TM.

Conclusions: Allowing for multiple comparisons, the significant markers of the risk for systemic embolization could be obtained only from TEE. Although there are several interesting clinical and echocardiographic associations with AT and a TM, none were strong enough to obviate the need for TEE. (J Am Soc Echocardiogr 2013;26:1099-105.)

Keywords: Atrial flutter, Catheter ablation, Atrial thrombus, Thrombogenic milieu, Spontaneous echocardiographic contrast

The risk for systemic embolization in patients with atrial fibrillation (AF) is both well known and widely believed to originate from clots formed in the left atrium.[1] Lack of organized mechanical activity in the atria is believed to lead to clot-promoting stasis of blood and ultimately to atrial thrombus (AT).[2] Furthermore, the risk for embolization is substantially increased at the time of cardioversion.[3] Knowledge of the thromboembolic potential of AF has led to recommendations in the guidelines of the American College of Cardiology and the American Heart Association that include chronic anticoagulation for most patients with sustained AF. Moreover, for most patients in whom restoration of sinus rhythm is planned and who have not been adequately anticoagulated, transesophageal echocardiography (TEE) aimed at the detection of AT is recommended before attempted cardioversion.[4] The guidelines further recommend that cardioversion be aborted in patients in whom AT is detected and undertaken only after a period of appropriate anticoagulation.

Data regarding the frequency of systemic embolization in patients with atrial flutter (AFl) are not as robust as those available for AF.[5,6] Nevertheless many physicians apply the AF guidelines to patients with AFl. At our institution and at many others, TEE is commonly

From the Department of Internal Medicine, Georgetown University Hospital, Washington, District of Columbia (D.A.); Georgetown University School of Medicine, Washington, District of Columbia (A.P., J.S.); and the Section of Cardiology, Washington Hospital Center, Washington, District of Columbia (A.B., E.X., S.G., J.M., J.L.).

Reprint requests: Daniel Alyeshmerni, MD, Department of Internal Medicine, Georgetown University Hospital, 3800 Reservoir Road NW, Washington, DC 20007 (E-mail: *dma22@georgetown.edu*)

0894-7317/$36.00

http://dx.doi.org/10.1016/j.echo.2013.05.017

Abbreviations
AF = Atrial fibrillation
AFl = Atrial flutter
AT = Atrial thrombus
LAA = Left atrial appendage
SEC = Spontaneous echocardiographic contrast
TEE = Transesophageal echocardiography
TM = Thrombogenic milieu

used to identify AT before cardioversion or radiofrequency ablation in the setting of subtherapeutic anticoagulation or of recent onset AFl that has persisted for >48 hours. Assuming that AT is a marker of increased risk for systemic embolism, its recognition should lead to measures to avoid or mitigated the risk.

Radiofrequency ablation of AFl has emerged as first-line therapy because of its curative potential and favorable affect on hospitalizations, quality of life, and AF development.[7-9] This development has led to an increasing volume of patients undergoing this procedure at our institution. Electrophysiologists performing these procedures have adopted the AF guidelines as the standard protocol for assessing the risk for periprocedural embolic risk.

Recognizing that TEE carries some risk, is a relatively expensive procedure, and can extend the length of hospital stay, we undertook this study to take advantage of both the increasing volume of patients and the standardization of the protocol. We aimed to determine the prevalence of AT and a thrombogenic milieu (TM) in an AFl cohort referred for radiofrequency ablation and to assess the necessity for preprocedural TEE for safety in patients scheduled for radiofrequency ablation.

METHODS

The study was approved by the MedStar Health Research Institute Institutional Review Board and is compliant with the Health Insurance Portability and Accountability Act.

Patients

From November 2008 through June 2010, 347 consecutive patients underwent transesophageal echocardiographic screening before scheduled radiofrequency ablation for AFl. All underwent histories and physical examinations before the procedure. Those in whom this was the first recognized episode of AFl were considered to have "new-diagnosis AFl." "Previous anticoagulation" was considered to have occurred in patients who had received warfarin therapy for ≥30 days preceding the procedure.

All patients were referred for TEE because (1) despite prescribed warfarin therapy, they had had subtherapeutic international normalized ratios (goal range, 2.0–3.0) during the previous month or (2) they had AFl persisting for ≥48 hours. If AT was identified on TEE, catheter ablation was delayed in favor of anticoagulation and reevaluation at a later date. If thrombus was not identified in any of the cardiac chambers, patients were allowed to proceed to catheter ablation.

Data Collection

Consecutive patients were identified from the electrophysiology laboratory's electronic logbook. Pertinent clinical features and echocardiographic findings were abstracted from clinical records and recorded in the study database.

Echocardiography

TEE was performed using commercially available equipment (Sonos 5500 or iE33; Philips Medical Systems, Andover, MA) and interpreted by very experienced echocardiographers (12 different echocardiographers, all level 3 certified) in the laboratory directed by one of the authors (S.G.). For this analysis, the formal reading of the examination as contained in the formal clinical report was used. All transesophageal echocardiographic examinations were conducted within 4 days of catheter ablation.

Transthoracic echocardiography was performed in most, but not all, patients. Left atrial dimension was determined from a long-axis view, and left ventricular ejection fraction was estimated visually.

Multiplane TEE was performed in a standard manner. Special attention was given to ensuring that the entire left atrium and the left atrial appendage (LAA) were recorded from the midesophageal view. A comprehensive evaluation of the mitral and aortic valves was performed from esophageal and gastric views to detect the presence of stenosis or regurgitation according to American Society of Echocardiography guidelines.[10,11] LAA emptying velocity was recorded by placing the pulse-wave Doppler cursor within 1 cm of the LAA orifice. Cine loops of the left atrium and the LAA were stored.

ATs were identified as independently mobile round, oval, or irregularly shaped echodensities (Figure 1). ATs were differentiated from pectinate muscles, because pectinate muscles lack mobility independent of the atrial wall, are relatively small and linear, and have a multiple, parallel ridgelike appearance, like the teeth of a comb.[12]

In addition to AT, we also chose a second marker of increased risk for embolization,[13] the presence of moderate or severe spontaneous echocardiographic contrast (SEC) indicating fibrinogen-dependent erythrocyte rouleaux formation.[14] One of the investigators (A.B.), while unaware of previous transesophageal echocardiographic readings or clinical information, reviewed the original transesophageal echocardiograms for the presence of SEC and graded its density. SEC was scored as absent (0), mild (1+), mild to moderate (2+), moderate (3+), or severe (4+), in accordance with the scoring system described by Fatkin *et al*.[15] This scoring system is explained in Table 1. Examples of moderate and severe SEC are illustrated in Figures 2 and 3. Patients with grade 3+ or 4+ SEC were grouped with patients with AT and classified as having a TM, as previously reported.[16]

Chronic renal insufficiency was defined as a documented baseline creatinine level > 1.4 mg/dL. Hyperthyroid and hypothyroid conditions were grouped and termed "thyroid disorders."

Statistical Analysis

Normally distributed continuous variables are reported as mean ± SD and were compared using Student's *t* tests for unpaired observations. Binary data are reported as proportions and percentages. Intergroup comparisons were made using χ^2 and/or Fisher's exact tests. Nominal data (e.g., degree of SEC) are reported as medians and interquartile variation and were compared using Wilcoxon's signed-rank test for matched pairs. In all cases, P values < .05 were considered statistically significant.

RESULTS

Prompt catheter ablation was undertaken in 328 of the 347 patients (94.5%) in whom no AT was detected and was postponed in the 19 (5.5%) with AT. In six of these 19 patients (31.6%), ablation was subsequently conducted after effective anticoagulation and after resolution of AT was confirmed by TEE. The median anticoagulation-imposed delay was 4 months. AFl had been present for ≥3 months