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The Role of Repeat Transesophageal Echocardiography in Patients without Atrial Thrombus Prior to Cardioversion or Ablation

Sakima A. Smith, MD, Philip F. Binkley, MD, MPH, Randi E. Foraker, PhD, Haikady N. Nagaraja, PhD, and David A. Orsinelli, MD
The Ohio State University, Columbus, Ohio

Abstract

Background—Cardioversion (CV) and radiofrequency catheter ablation (RFA) are often used to restore sinus rhythm in patients with atrial fibrillation (AF). These procedures are associated with a risk for stroke. The use of transesophageal echocardiography (TEE) to guide the management of AF is a validated strategy for patients in whom CV is planned, as well patients before RFA. For patients in whom the initial procedure fails, repeat TEE is often performed before repeat CV or RFA. The aim of this study was to test the hypothesis that patients with initial negative results on TEE would be unlikely to have thrombi detected on subsequent TEE and thus may avoid repeat procedures.

Methods—A total of 2,999 patients with AF were identified via retrospective review who had undergone TEE before CV or RFA, and 418 of these individuals underwent repeat TEE. After excluding patients who underwent repeat TEE >365 days from the initial study ($n=135$) and those with thrombi on initial TEE ($n=20$), 263 patients who had undergone two or more examinations were identified and analyzed.

Results—Of 263 eligible patients, two (0.8%; 95% confidence interval, 0.21–2.7%) had thrombion subsequent TEE.

Conclusions—Fewer than 1% of patients with AF with negative results on baseline TEE had thrombi detected on repeat TEE before subsequent CV or RFA. Thus, it may be possible to selectively screen patients to identify those at low risk for developing thrombi subsequent to negative results on initial TEE, especially if patients are in sinus rhythm. These results suggest the need for a prospective trial to definitively answer the question regarding repeat TEE in low-risk patients. (*J Am Soc Echocardiogr* 2012;25:1106–12.)

Keywords

Atrial fibrillation; Atrial flutter; Electrical cardioversion; Transesophageal echocardiography

Atrial fibrillation (AF) is the most common clinically significant cardiac arrhythmia. It has an overall prevalence of 1%, and approximately 2.3 million US adults currently have AF. This will likely increase to >5.6 million by 2050, with >50% of affected individuals aged 80 years, making it a significant public health issue.¹ It is also a potent risk factor for ischemic stroke, increasing the risk for stroke fivefold.² Symptomatic AF and atrial flutter (AFL) may also reduce quality of life and functional status. Both are associated with higher

medical costs as well as an increased risk for death.^{1,3} Electrical cardioversion (CV) is often used to restore normal sinus rhythm (NSR) in patients with AF, but the procedure is associated with a risk for stroke, which may result if left atrial thrombi are dislodged when NSR is restored. Transesophageal echocardiography (TEE)-guided CV is a clinically validated strategy for patients in whom CV is planned to guide the management of AF or AFL.⁴ TEE is a semi-invasive and somewhat costly procedure with some inherent risks to patients.

Radiofrequency catheter ablation (RFA) is being used with increasing frequency to help restore or maintain NSR in patients with AF or AFL. Current clinical practice at many institutions is to perform TEE before RFA, even if the patient is in NSR. At many institutions, patients who undergo ablation have TEE first, irrespective of their rhythms, international normalized ratios (INR), or risk for thrombus. In addition, many patients, especially those with inadequate or uncertain anticoagulation status, undergo TEE before CV. This is often the case even in patients with prior preprocedural TEE.

It is imperative to risk-stratify patients before repeat CV or RFA. This requires judicious review of the patient's medical history and underlying risk factors. With rising medical costs and the potential for adverse events with TEE, it is of interest to identify patients who can safely proceed to repeat CV or RFA without repeat TEE. Identifying low-risk patients with prior TEE who can safely proceed to repeat procedures without repeat TEE may reduce costs without compromising patient safety.

We hypothesized that individuals with negative results on initial TEE would be unlikely to have thrombi detected on subsequent TEE and thus may avoid repeat preprocedural TEE. In addition, we sought to determine if there were any clinical or echocardiographic parameters present at the time of initial TEE that would predict the formation of left atrial appendage (LAA) thrombus. We therefore retrospectively reviewed our experience to determine the incidence of thrombus detection in patients with initial negative results.

Methods

Study Population

We conducted a retrospective review of patient data at The Ohio State University Medical Center, which was approved by The Ohio State University institutional review board. We identified 2,999 patients from 2000 to 2009 (using The Ohio State University's Information Warehouse database with the specific query "atrial fibrillation/flutter precardioversion/rule out thrombus") who underwent TEE for AF or AFL before CV or RFA. We analyzed all patients who underwent two or more preprocedural transesophageal echocardiographic exams for AF or AFL ($n = 418$). We excluded those who underwent repeat TEE >365 days from the index exam ($n = 135$) and those who had thrombi on their initial exams ($n = 20$). We thus identified 263 patients who had at least two transesophageal echocardiographic studies, of which the results of the first were negative for thrombus. These patients underwent initial TEE immediately before CV or RFA. Their second (and subsequent) exams were performed before repeat CV or RFA procedures. The remaining 2,581 patients who did not undergo repeat TEE had only a single CV or RFA procedure. We included all patients who met our initial inclusion criteria irrespective of valvular disease to assess the overall incidence observed in our TEE laboratory. Although valve disease makes it less likely that repeat TEE could be avoided, we assessed the thrombus risk for all individuals. We also performed a random 1-year sample of our database to determine the incidence of left atrial thrombus.

Clinical Data

We retrospectively calculated a clinically validated stroke risk index, the CHADS₂ score, for each patient on the basis of clinical data available at the time of index TEE.⁵ The CHADS₂ score ranges from 0 to 6 and is calculated as follows: 1 point for congestive heart failure; 1 point for hypertension; 1 point for age ≥ 75 years; 1 point for diabetes; and 2 points for history of stroke, cerebrovascular accident, transient ischemic attack, or systemic embolism. We also calculated (retrospectively) a more recent stroke risk stratification schema, the CHA₂DS₂-VASc score (1 point for cardiac failure or dysfunction, 1 point for hypertension, 2 points for age ≥ 75 years, 1 point for diabetes, 2 points for stroke, 1 point for vascular disease or history of myocardial infarction, 1 point for age 65–74 years, and 1 point for sex category [female]), again on the basis of clinical data available at the time of initial TEE.⁶ The score ranges from 0 to 9, and a score ≥ 2 identifies those at high risk for thromboembolic events. Low thromboembolic risk is defined as a CHADS₂ or CHA₂DS₂-VASc score of 0 or 1, and high-risk patients have scores ≥ 2. We compared high-risk and low-risk groups using both risk stratification schemes. We also performed a direct comparison between high-risk CHADS₂ and CHA₂DS₂-VASc groups. The INR was recorded at the time of TEE and <30 days before the procedure if available.

We assessed the incidence of thrombus on the first subsequent follow-up transesophageal echocardiographic exam in patients who met inclusion criteria. Two investigators (D.A.O. and S.A.S.) reviewed all repeat exams with positive findings. We excluded four patients who demonstrated thrombi on device wires ($n = 3$) on repeat TEE or at the septal perforation site ($n = 1$), as this is a separate physiologic process from thrombus formation in the LAA. Thrombi on the device wires did not preclude proceeding to RFA or CV. One patient with a thrombus on the right atrial side of the interatrial septum at the site of a previous septal perforation had CV delayed by 4 weeks. LAA thrombus was defined as a mass adherent to the wall of the LAA displaying either independent motion or different echogenic density.⁷

We further compared patients in NSR with those in AF or AFL at the time of their repeat studies to assess the role this may have played with regard to new spontaneous echocardiographic contrast (SEC) formation. We also evaluated the time interval to repeat TEE for all patients and within the subgroups of NSR and AF or AFL.

Echocardiographic Data

Standard techniques were used to perform TEE. Specifically, level 2 and 3 echocardiographers followed the laboratory protocol using a Philips multiplane probe (Philips Medical Systems, Andover, MA). Covariates of interest included left atrial size > 4.5 cm (because this is known to affect the success of CV),⁸ the degree of valvular heart disease (defined as negative if no disease or mild stenosis or regurgitation and as positive if more than mild stenosis or regurgitation), the presence of SEC, LAA velocity, and left ventricular ejection fraction (LVEF). Left atrial enlargement was determined from clinical reports using a left atrial anteroposterior diameter > 45 mm. The severity of valvular disease was defined by clinical reports and semi-quantitated by the individual reader. SEC was defined as swirling patterns of echogenicity in the left atrium and LAA distinct from white-noise artifact.⁷ We did not quantify the severity of SEC. We graded SEC indicated in clinical reports as either present or absent, reducing the potential for interobserver variability. LVEF was determined using the most recent transthoracic echocardiographic report available. If no transthoracic echocardiogram was available, LVEF from the transesophageal echocardiographic report was used. LVEF was determined by the individual reader using semiquantitated methods by means of visual estimation or the biplane Simpson's method in those studies with adequate volumetric measures. LAA velocity was also determined from clinical reports.

Statistical Analysis

Study data were stored in the Research Electronic Data Capture database, an electronic data capture tool hosted at The Ohio State University.⁹ Research Electronic Data Capture is a secure, Web-based application designed to support data capture for research studies.

Continuous data are presented as mean $\pm$ SD. Continuous variables were assessed for normality and were compared using Student's *t* tests. Categorical variables were analyzed using contingency tables and McNemar's test statistic with Yates's correction for continuity. Values resulting in $P < .05$ were deemed statistically significant. Statistical calculations were performed using JMP version 8.0 (SAS Institute Inc., Cary, NC).

Results

Patient Demographics and Clinical Characteristics

The incidence of left atrial thrombus on initial TEE before CV or RFA for patients in AF was 7% (29 of 423). Our study population included 263 patients, with the majority being Caucasian men (see Table 1). The mean age was 59 ± 11 years. The average number of repeat transesophageal echocardiographic exams was 1.8 (range, 1–8; Figure 1). Of the 263 patients, 76% had one repeat study, 15% had two repeat studies, and 9% had three or more repeat studies. The mean interval until the first repeat study was 130 ± 99 days. We found no differences ($P > .05$) between baseline and repeat TEE in terms of LVEF, the percentage of patients in NSR, the presence of SEC, or LAA velocity (Table 2). Two thirds of patients were in AF or AFI. The average INR at the time of initial TEE was 1.69 ± 0.65 and was higher (1.83 ± 0.61) at the time of repeat TEE ($P < .0099$; Table 2). There were 107 patients (41%) with some degree of valve disease (greater than mild valvular regurgitation or stenosis). With regard to “high-risk” patients (patients with valve disease that increased their risk for a thromboembolic event), 2.8% of those with valve disease had mechanical mitral valve replacement, 0.9% had bioprosthetic mitral valves, 2.8% had mechanical aortic valve replacement, 3.7% had bioprosthetic aortic valves, 0.9% had bioprosthetic tricuspid valves, and 3.7% had mitral stenosis. Collectively, 15% of the patients with valve disease were particularly high risk patients.

Clinical Outcomes

Of the 263 patients, only two (0.8%; 95% confidence interval, 0.21–2.7%) underwent repeat TEE with positive results for thrombus formation. In both patients, the thrombus was identified in the LAA (Figure 2). Both individuals were in AF and also had SEC and left atrial enlargement during their baseline studies. LVEFs at the time of repeat TEE were 20% for both patients. One patient had a subtherapeutic INR of 1.9 at the time of repeat TEE. The INR was 2.2 in the other individual. Neither patient had a therapeutic INR during the 30 days before repeat TEE. Their CHADS₂ scores were 1 and 3, respectively, and their CHA₂DS₂-VASc scores were 2 and 6 (Tables 3 and 4).

Many patients in our study (61%) had INRs < 2 at the time of repeat TEE (Figure 3). Of the 102 patients with INRs > 2 at the time of repeat TEE, data were not available for 80 patients regarding their anticoagulation status for the preceding 30 days. Twenty-two patients had INR data for the 30 days before repeat TEE, and only nine had therapeutic INRs (Figure 3). None of these individuals had thrombi on repeat TEE (Tables 3 and 4).

Patient Characteristics by Rhythm

To better define our cohort, we also compared patients by rhythm (NSR vs AF or AFI) at the time of repeat TEE. There were no significant differences between the groups with respect to age, congestive heart failure, diabetes, hypertension, INR, LVEF, cerebrovascular

accident, and valve disease (Table 5). Patients in NSR had significantly higher LAA velocities than patients in AF or AFI (49.2 ± 21.6 vs 37.6 ± 18.2 cm/sec, $P = .0002$), and those in NSR also had less SEC present (16.3% vs 43.8% , $P < .0001$). Rhythm at the time of repeat TEE did not have an impact on new SEC formation (Table 5)

The mean interval to first repeat TEE differed significantly on the basis of rhythm. On average, patients in NSR had their first repeat studies at 154 ± 102 days (Figure 4). However, those in AF or AFI had their first repeat studies at 117 ± 95 days on average ($P = .0033$). In both groups, the majority of the repeat exams occurred within 6 months.

Comparisons on the Basis of CHADS₂ and CHA₂DS₂-VASc Scores

We used the CHADS₂ and CHA₂DS₂-VASc scoring systems to identify high-risk (score 2) and low-risk (score 0 or 1) cohorts. The mean CHADS₂ score was 1.33 ± 1 , and the mean CHA₂DS₂-VASc score was 2.30 ± 1.5 . When comparing the CHA₂DS₂-VASc score with the CHADS₂ score, in contrast to the CHADS₂ low-risk cohort, no thrombi were detected in the low-risk CHA₂DS₂-VASc group on repeat TEE (Table 6). Also, when using the CHA₂DS₂-VASc score compared with the CHADS₂ score, significantly more patients were identified as being at high risk (66% vs 41% , $P < .001$) when stratifying the risk schemes into low-risk and high-risk cohorts (Table 6).

Discussion

Our goal was to determine the incidence of thrombus detection in patients with initially negative results on TEE. Our data suggest that the overall incidence of a thrombus on a repeat study is quite low. Over a 10-year period, $<1\%$ of patients who had histories of AF or AFI and negative results on initial TEE for thrombus before CV or RFA had thrombi detected during repeat TEE (performed within 1 year of the initial study) before subsequent CV or RFA. Our data thus suggest that few patients will have thrombi on repeat TEE after prior negative results on TEE. Although we evaluated patients with repeat TEE within 1 year of their initial studies, the majority of patients, irrespective of their rhythms, underwent repeat TEE within 6 months of the initial procedures (Figure 4).

The overall incidence of finding an atrial thrombus in patients with AF undergoing TEE before CV or RFA was 7%. This is lower than the 9% to 15% reported in the literature,^{4,10,11} which is likely explained by the fact that our population is not reflective of patients seen in other studies, such as the Assessment of Cardioversion Using Transesophageal Echocardiography study, in which all patients had AF at entry and had not been anticoagulated before entry.⁴

Many of our patients were in NSR (before undergoing RFA), and many were anticoagulated (albeit often with subtherapeutic INRs). All patients had INRs at the time of initial and repeat TEE, but 30-day INRs were missing in many patients because sometimes, the INR is assessed at an office or another institution, and our database does not reflect these trends (Figure 3). No patient who was in NSR at the time of repeat TEE developed a thrombus, irrespective of LVEF, left atrial size, or INR. There were no cases of thrombus detected in patients with low-risk CHA₂DS₂-VASc scores, while a thrombus was detected in one patient with a low-risk CHADS₂ score, suggesting that the CHA₂DS₂-VASc score may perform better in this group.¹² It is prudent to emphasize that the CHADS₂ and CHA₂DS₂-VASc scores were not developed to assess thrombus formation but were designed to predict thromboembolic risk.

Thrombus, Thromboembolism, and the Role of TEE

After having an embolic stroke in the setting of new-onset AF, patient 2 (Tables 3 and 4) was converted to NSR after TEE revealed normal LVEF and no thrombus. She was discharged to a rehabilitation facility because of the stroke. Nineteen days later, she was found to be tachycardic to a heart rate of >140 beats/min and was found to be in AFL. Repeat TEE revealed an LVEF of 20% and a left atrial thrombus. Her INR was 2.2 at the time of repeat TEE, although she was not therapeutic for >30 days before repeat TEE. In all likelihood, her depressed left ventricular systolic function was tachycardia mediated from the flutter, and this may have played a role in her developing a thrombus (along with inadequate anticoagulation).¹³ This patient had an extremely high CHA₂DS₂-VASc score of 6, which is associated with an increased risk for thromboembolism.¹² Both patients in our study who developed thrombi had evidence of SEC on initial TEE, and that too has been identified as a predictor for thrombus formation.¹⁴⁻¹⁸ Patient 1 (Tables 3 and 4) had an LVEF of 15% on initial TEE, and his LVEF was 20% at the time of the repeat procedure 56 days later. He never had a therapeutic INR, he was in AF, and repeat TEE before CV revealed a thrombus in the LAA (Figure 2).

The Role of Risk Stratification

Although our study was not designed to assess whether initial TEE could be avoided, there are data suggesting that risk stratification is reasonable for certain low-risk populations at the time of initial TEE before CV of RFA. Variables identified included a normal LVEF, normal left atrial size, and a low CHADS₂ score.¹⁹⁻²³ We were able to identify one study in the literature that assessed whether repeat TEE was warranted after an initial procedure with negative results. The investigators in that small ($n = 76$), retrospective study identified patients who were insufficiently anticoagulated before repeat TEE for pre-CV for the return of AF.²⁴ The investigators argued that in insufficiently anticoagulated patients, repeat TEE is necessary before CV for recurrent AF even if previous TEE showed no atrial thrombi. This was based on an incidence of thrombus on repeat TEE of 10.5%. This is in stark contrast to our observed incidence of thrombus on repeat TEE of <1%. The incidence reported in the aforementioned study may have been higher because they did not exclude patients who underwent repeat TEE >1 year later. In addition, all of the patients who developed thrombi had evidence of structural heart disease (mean LVEF, 33%). An important point emphasized by the investigators is that the prevalence of SEC was significantly higher in patients with intra-atrial thrombi (seven of eight [87.5%]) than in patients without intra-atrial thrombi (13 of 68 [19.1%]) ($P < .05$). Both patients in our study who developed thrombi had evidence of SEC. Although the investigators in the earlier study intentionally included patients who were insufficiently anticoagulated, the mean INR at the time of repeat TEE in our study was only 1.83, so many patients in our study were insufficiently anticoagulated as well. The risk for having a thrombus while in AF and being insufficiently anticoagulated may be as high as 9.9%.²⁵ Despite these findings, we identified only one patient who had a thrombus while having an INR < 2.

Limitations

The present study was not without limitations. It was a retrospective, single-center review with inherent selection bias that may be seen in a large tertiary care referral center. Our results will need to be demonstrated in a prospective study before definitive statements can be made regarding the role of repeat TEE in patients with AF or AFL at the time of repeat CV or RFA. We acknowledge that referral bias is likely an inherent weakness of this retrospective study as well. Because we only found two patients with thrombi, we had limited power to detect statistically significant predictors for thrombus formation during repeat TEE. Because of the retrospective nature of this study, and the fact that many different centers and physicians monitored INRs, data regarding INRs before repeat TEE

were not available for many patients. Also, SEC, LVEF, valve disease, and left atrial size were determined from clinical reports.

Several important issues remain open for debate. For example is a patient who has been in NSR for just 1 day before CV or RFA still at low risk? Because of the retrospective nature of our study, it may be inappropriate to extrapolate our study results to patients whose INRs have been substantially lower. We do not know the importance of the duration of insufficient anticoagulation. There may be other risk factors (such as left atrial size) that need to be taken into consideration. Our defined “warranty period” may be more valid within the first 6 months after initial TEE. And although 15% of the patients in our study with valve disease had high-risk features and still did not develop thrombi on repeat TEE, it is unlikely that repeat TEE could be avoided in this subset of individuals. These results and the aforementioned unresolved issues suggest the need for a prospective trial to definitively answer the question regarding repeat TEE in low-risk patients.

Conclusions

As demonstrated in previous studies, risk stratification at the time of initial TEE is reasonable in low-risk patients before initial CV or RFA. The question remains whether the same approach is safe and justified in patients who require repeat TEE after the initial study shows negative results for thrombus. These data, although thought provoking, can only generate hypotheses and should not be implemented in clinical practice at this time, because of the inherent limitations of the retrospective design of this study and the small sample size. Nevertheless, our findings suggest in a broad, unselected population of patients presenting for repeat TEE for CV or RFA that the incidence of finding a thrombus is exceedingly low if the initial study results were negative.

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Abbreviations

AF	Atrial fibrillation
AFI	Atrial flutter
CV	Cardioversion
INR	International normalized ratio
LAA	Left atrial appendage
LVEF	Left ventricular ejection fraction
NSR	Normal sinus rhythm
RFA	Radiofrequency catheter ablation
SEC	Spontaneous echocardiographic contrast
TEE	Transesophageal echocardiography

Figure 1. Total number of repeat transesophageal echocardiographic studies performed. The vast majority of patients (76%) had at least two repeat studies.

Figure 2.

Patient 1 had an LVEF of 15% at initial TEE, and his LVEF was 20% at the time of the repeat procedure 56 days later. Initial TEE did not reveal a thrombus before CV for AF (**A**). He never had a therapeutic INR, he was in AF, and repeat TEE (**B**) before CV revealed a thrombus in the LAA (*red arrow*). The red asterisk demonstrates pectinate muscle bundles.

Figure 3.

Many patients in the study (61%) had INRs < 2 at the time of repeat TEE. Of the 102 patients with INRs > 2 at the time of repeat TEE, data were not available for 80 patients regarding anticoagulation status for the preceding 30 days. Twenty-two patients had INR data for the 30 days before repeat TEE, and only nine had therapeutic INRs. None of these individuals had thrombi on repeat TEE.

Figure 4.

Time to repeat TEE. Patients with AF or AFL on average underwent repeat TEE 1 month earlier than patients in sinus rhythm (117 ± 95 vs 154 ± 102 days, $P = .0033$). The boxes in the top plots represent the three quartiles (from right to left, Q1 [25th quartile], Q2 [median or 50th quartile], and Q3 [75th quartile]), and the whiskers (*red lines*) cover the range of values. At least, 25% of all values were below the lower quartile (Q1), 50% of all values were below (or above) the median (Q2), and 25% of all values were above the upper quartile (Q3).

Table 1Baseline demographic data ($n = 263$)

Variable	Value
Age (y)	59 ± 11
Men	66%
Caucasian	95%
Diabetes mellitus	23%
Hypertension	64%
Cerebrovascular accident or transient ischemic attack	6%
Congestive heart failure	28%
History of myocardial infarction or vascular disease	35%
Interval to repeat TEE (d)	130 ± 99
CHADS ₂ score	1.33 ± 1
CHA ₂ DS ₂ -VASc score	2.30 ± 1.5

Data are expressed as mean $\pm$ SD or as number (percentage)

Table 2Baseline and repeat measurements ($n = 263$)

Variable	At baseline TEE	At repeat TEE	<i>P</i>
LVEF (%)	49.9 ± 13	48.8 ± 13	.0512
INR	1.69 ± 0.65	1.83 ± 0.61	.0099 [*]
Sinus rhythm	37%	35%	.6477
SEC	32%	35%	.3329
LAA velocity (cm/sec)	41.3 ± 20	42.3 ± 20	.6333

Data are expressed as mean ± SD or as percentages.

^{*} Significant at $P < .05$.

Table 3

Characteristics of the two patients who developed thrombi on repeat TEE

Patient	Rhythm at repeat TEE	SEC	Age (y)	Baseline LVEF (%)	Repeat LVEF (%)	Baseline INR	Repeat INR	Therapeutic INR for 30 d before repeat TEE	CHADS ₂ score (range, 0–6)	CHA ₂ DS ₂ -VASc score (range, 0–9)	Interval to repeat TEE (d)
1	AF	Yes	70	15	20	1.1	1.9	No	1	2	56
2	AF	Yes	56	55	20	1.1	2.2	No	3	6	19

Table 4

Characteristics of the nine patients with INRs > 2.0 for 30 days before repeat TEE

Patient	Age (y)	Sex	Rhythm on repeat TEE	Thrombus	Baseline LVEF (%)	Repeat LVEF (%)	INR	CHA ₂ DS ₂ -VASc (range, 0–9)	CHADS ₂ score (range, 0–6)	SEC	LAA velocity (cm/sec)
1	67	Male	NSR	No	NA	55	2.1	3	2	Yes	32
2	68	Male	AF/AFI	No	40	50	3.2	5	3	Yes	40
3	55	Female	NSR	No	40	20	2.2	3	2	Yes	NA
4	63	Male	AF/AFI	No	45	45	2.0	3	2	Yes	26
5	51	Female	NSR	No	35	55	2.5	1	0	No	40
6	68	Male	AF/AFI	No	60	60	2.8	2	1	No	35
7	55	Male	AF/AFI	No	55	40	2.2	1	1	No	80
8	55	Male	NSR	No	60	60	2.8	2	1	No	45
9	39	Male	AF/AFI	No	25	25	2.3	1	1	No	30

NA, Not available.

Table 5

Subgroup characteristics at the time of repeat TEE

Variable	NSR (<i>n</i> = 92 [35%])	AF/AfI (<i>n</i> = 171 [65%])	<i>P</i>
Age at repeat TEE (y)	57.4 ± 10.3	59.7 ± 11.7	.12
Thrombus on TEE	0	2 (1.2%)	.54
LVEF (%)	50.7 ± 12.8	47.7 ± 13.4	.08
Congestive heart failure	21.7%	31.4%	.11
Diabetes	25%	20.7%	.44
Hypertension	65.2%	64.3%	.89
Cerebrovascular accident/transient ischemic attack	2.2%	7.7%	.09
INR	1.80 ± .53	1.84 ± 0.65	.70
LAA velocity (cm/sec)	49.2 ± 21.6	37.6 ± 18.2	.0002 *
Valve disease	35.9%	43.2%	.29
SEC present	16.3%	43.8%	<.0001 *
Number of patients who developed new SEC	10	19	.239

Data are expressed as mean ± SD or as percentages.

* Significant at *P* < .05.

Table 6CHA₂DS₂-VASc score versus CHADS₂ score

Variable	CHADS ₂	CHA ₂ DS ₂ -VASc	<i>P</i>
Number of patients with thrombi on repeat TEE (score 0 or 1)	1 (0.64%)	0	NS
Number of patients with thrombi on repeat TEE (score 2)	1 (0.93%)	2 (1.2%)	NS
High-risk patients (score 2)	41%	66%	<.0001 *

* Significant at $P < .05$.