

USING TRANSESOPHAGEAL ECHOCARDIOGRAPHY TO GUIDE EARLY CARDIOVERSION

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Despite its proven safety, efficacy, and cost-effectiveness in guiding early cardioversion, transesophageal echocardiography is used rarely for this purpose by cardiologists in community hospitals. Is lack of experience the reason—and, if so, is that a valid concern?

The use of transesophageal echocardiography (TEE) to guide early cardioversion (CV) from atrial fibrillation (AF) was first reported in 1993, when it was tested on a series of 94 patients.¹ Multicenter studies performed since this first report—most notably the Assessment of Cardioversion Utilizing Transesophageal Echocardiography (ACUTE) study²—report that this procedure is a feasible alternative to the traditional approach in which patients receive a three-week course of warfarin anticoagulation therapy prior to CV.³ Nevertheless, a 2000 survey of car-

diologists practicing across the country revealed that TEE is employed in only 12% of all CVs, and its use is particularly low in community hospitals.⁴

Since, in that study, each institution's use of TEE-CV correlated with its total volume of TEE procedures (and, therefore, with greater practitioner exposure to TEE procedures), the authors surmised that one reason for the low usage nationwide could be lack of physician training. They found that high volume usage of the procedure occurred at academic and tertiary care institutions.

The purpose of the current study was to determine the safety and efficacy of TEE-CV as performed by newly trained cardiologists in a community veterans hospital in which overall procedure volumes are low. The importance of this issue was highlighted by Klein and colleagues in their clinical review

of TEE-CV, in which they question the feasibility of using this approach in community hospitals.⁵

METHODS AND MATERIALS

The study was performed by two board certified cardiologists with recent level III echocardiography training and a minimum of 75 prior TEE studies each. Both had completed training less than five years before study initiation.

Between October 1996 and August 2000, 40 patients with AF of recent onset or unknown but presumed recent onset were admitted and considered for electrical CV. All were offered a choice of either three weeks of anticoagulation therapy followed by CV or TEE followed by CV in the absence of left atrial thrombi. Five chose the former treatment; the remaining 35 elected to have TEE-CV. These 35 patients formed our study group (Table 1).

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Table 1. Baseline characteristics of the study group (n = 35)

Age (mean ± standard deviation)	68 ± 10
Gender	Male: 35 (100%)
Left atrial size	Normal: 2 (6%); dilated*: 33 (94%)
Left ventricle size	Normal: 24 (68%); dilated†: 11 (32%)
Left ventricular function	Normal‡: 17 (48%); mildly reduced§: 8 (23%); moderately reduced¶: 3 (8%); severely reduced‡: 7 (20%)
*Dilated left atrium defined as > 3.9 cm. †Dilated left ventricle defined as > 5.9-cm cavity in end diastole. ‡Left ventricular function normal if ejection fraction is > 55%. §Mild reduction defined as 45% to 55%. ¶Moderate reduction defined as 35% to 45%. ‡Severe reduction defined as < 35%.	

Patients opting for TEE-CV were admitted to the hospital and given a regimen of IV heparin at a loading dose of 5,000 U and a maintenance dose sufficient to keep the partial thromboplastin time (PTT) between 1.5 and two times the normal value and oral warfarin at a dose sufficient to keep the international normalized ratio (INR) between 2 and 3. Once their PTT values were 1.5 to two times the normal value with heparin, they underwent TEE to rule out intracardiac thrombi.

TEE was performed using an Acuson XP128 machine (Acuson, Mountain View, CA) equipped with 3.5-, 5-, and 7-MHz transesophageal probes. Patients were sedated using IV midazolam 1 to 2 mg, and oropharyngeal anesthesia was provided through a topical lidocaine spray. The transesophageal probe was inserted into the esophagus and the left atrium. The left atrial appendage, interatrial septum, right atrium, and right atrial appendage were visualized in transverse and horizontal axes at 7 MHz.

A thrombus was defined as the appearance of a well circumscribed echodense mass in any of the areas visualized. Spontaneous echo contrast was defined as swirling intracavitary movement of blood. In each study, investigators categorized thrombi as present or absent. No provision was made for an indeterminate category. If no thrombi were identified, we proceeded with electrical CV.

The TEE probe remained in the esophagus during CV, and we obtained post-CV repeat images of the left atrium and appendage. For CV, additional IV midazolam 2 mg and fentanyl 2 to 20 µg/kg were given by an anesthesiologist. Respiration was assisted with supplemental oxygen by mask as required. Direct current CV was attempted with shocks at 100, 200, 300, and 360 J as needed. Following successful CV, patients continued to receive IV heparin in the hospital at doses adjusted to keep PTT between 1.5 and two times the normal value until their INR could remain therapeutic with warfarin alone. They

were then discharged with a prescribed regimen of warfarin therapy and followed as outpatients.

RESULTS

Of the 35 patients who underwent TEE, 28 (80%) had no left atrial thrombi. These patients underwent electrical CV. The procedure was successful in 18 (64%) while the other 10 (36%) remained in AF. No patient had clinical complications from TEE or CV. Although failed CV generally is considered benign, one patient developed a new thrombus in the left atrial appendage following unsuccessful CV—a case that was reported previously.⁶ All patients whose CV was successful were observed in the hospital overnight, and all of them remained in sinus rhythm for at least 24 hours after CV.

IMPLICATIONS FOR PRACTICE

The important findings of this study are that board certified cardiologists with recent level III echocardiography training can perform TEE-CV with minimal risk, yielding clinically useful information. Following CV, there were no cerebrovascular events in any of the patients in whom no thrombi were detected. Nor did any of the patients who underwent CV have any embolic events or TEE-related procedural complications. In our series there were no indeterminate studies, so TEE provided useful information in 100% of the cases. It's also notable that the vast majority of patients wanted to have TEE-CV rather than conventional CV preceded by three weeks of anticoagulation therapy.

TEE has a reported sensitivity nearing 100% and a specificity of 99% in detecting left atrial and appendage thrombi.⁷ TEE-CV has

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been shown to be a safe and effective alternative to conventional CV preceded by anticoagulation.⁸ By reducing the need for pre-CV anticoagulation therapy, TEE-CV lowers the risk of bleeding.⁶ And by allowing earlier CV than the conventional approach, it may help prevent atrial remodeling and, therefore, recurrence of AF.

Compared to conventional CV preceded by anticoagulation, TEE-CV has shown no overall advantage in reducing the small risk of post-CV thrombosis and embolism—though it may be safer in patients with a high probability of atrial thrombosis. Prior studies have shown that some atrial thrombi are not resolved after four weeks of anticoagulation therapy. Thus, for patients with preexisting thrombi, the conventional approach provides no assurance that all thrombi will have been eliminated by the time of the procedure.⁹

The TEE-CV approach also may be more cost-effective than the conventional approach.¹⁰ AF is the arrhythmia that occurs most commonly in older patients. Undoubtedly, as the population ages, the incidence of AF will rise. It's been reported that 60% of patients admitted for AF, have been in AF for less than one month.¹¹ Since duration of AF is the major determinant of successful CV and maintenance of sinus rhythm, a large number of these patients are likely candidates for CV. By adopting the TEE-CV approach, patients can undergo CV during their first hospitalization, eliminating the need for a second admission and resulting in substantial cost savings.¹⁰ In that TEE-CV also may reduce costs associated with major hemorrhagic complications, additional cost savings may be realized.

The cost-effectiveness of TEE-CV, however, requires TEE to be performed with no complications and to yield a high frequency of diagnostic results. Both TEE's safety and accuracy may depend on practitioner experience. It can be challenging to distinguish dense spontaneous contrast from a thrombus, and the practitioner's experience and training may affect the number of studies considered indeterminate. In this study, the presence or absence of thrombi could be determined in 100% of cases.

REQUIRED TRAINING

In conclusion, TEE-CV can be performed safely and with excellent results in a community hospital by cardiologists who have level III echocardiography training. Performing at least 75 TEE studies during training, as recommended by the task force for training in echocardiography,¹² is adequate for this procedure. ●

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