Transesophageal Assessment of Left Atrial Thrombus Using a 3.3-mm Monoplane Probe

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Objectives: **Our study was designed to demonstrate that transesophageal echocardiography using a 3.3-mm monoplane probe can accurately evaluate the left atrium for patients with arrhythmias before cardioversion.**

Background: **Standard probes cause discomfort during intubation requiring sedation, but miniature probes do not.**

Methods: **With topical anesthesia alone, a 3.3-mm probe was used for transesophageal echocardiography in 60 patients. After intravenous sedation, standard transesophageal echocardiography was then performed.**

Results: **In 51 of 60 patients, the left atrium was visualized with the 3.3-mm probe. In 43 of 51 patients the appendage was clear. A thrombus was seen in 7 patients on both studies. In one patient spontaneous echocontrast was seen only with the 3.3-mm probe (sensitivity 100%, specificity 97%). In 9 of 60 patients, the appendage could not be assessed.**

Conclusions: **In many patients the 3.3-mm probe can visualize the appendage and obviate the need for sedation. Technical advances will improve image quality with miniature probes.** (J Am Soc Echocardiogr 2005;18:1381-1384.)

Atrial fibrillation is the most common sustained tachyarrhythmia encountered in cardiology practice.[1] Its prevalence increases with age and the presence of underlying heart disease, occurring in less than 0.5% of those younger than 40 years and greater than 16% of those older than 80 years. Based on these percentages, it has been estimated that atrial fibrillation currently affects 2.3 million US adults. Furthermore, as the population ages, the number of adults affected is expected to increase 2.5-fold by the year 2050.[2] Early cardioversion after exclusion of atrial thrombi with transesophageal echocardiography (TEE) is an accepted strategy for this common arrhythmia.[3] Traditional omniplane probes are large (12-18 mm in diameter) and can cause discomfort during entry into the esophagus. Primarily because of their size, traditional TEE studies often require moderate levels of sedation. Conscious sedation is associated with drug-induced respiratory depression, airway obstruction, hypotension, or arrhythmia in up to 0.5% to 2.0% of procedures.[4,5] Sedation also adds to the cost and time of TEE because of the need for additional nursing care, monitoring equipment, and intravenous sedatives, and limits the performance of the procedure to special facilities. Complications of sedation and intolerance of the standard probe are the primary reasons studies are not performed or not completed. In considering alternate approaches to make this common procedure more tolerable, we compared TEE imaging of the left atrium (LA) without sedation using a 3.3-mm monoplane probe with imaging using a standard 12-mm omniplane probe requiring sedation in patients with atrial arrhythmias undergoing echocardiography before cardioversion.

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METHODS

With institutional review board permission, 60 consecutive patients scheduled to undergo standard TEE to rule out thrombus in the LA or LA appendage (LAA) before cardioversion were studied. The study probe used was a 3.3 mm–wide, 90 cm–long catheter the tip of which includes a 64-element, phased array of crystals that create a 90-degree imaging sector in the longitudinal plane. The probe uses a frequency range of 5.5 to 10 MHz for 2-dimensional imaging and has color and spectral Doppler capability. It connects to standard, commercially available ultrasound systems (Sequoia, Acuson/Siemens Erlangen, Germany) using a special adapter. The 3.3-mm probe was developed by Acunav/Siemens predominantly for intracardiac use but has been shown to be safe using a TEE approach.[6]

For our study, patients initially received topical anesthesia with viscous lidocaine and cetacaine spray and then the 3.3-mm study probe was introduced. A complete examination with the 3.3-mm probe included 2-dimensional imaging of the LA and LAA using sweeps in the

longitudinal plane. The right atrium was visualized in a bicaval view. Pulse wave (PW) Doppler of the LAA was also performed. Patients were then given intravenous sedation and TEE images with a standard adult omniplane probe (imaging frequency 4-7 MHz) were performed. Similar to the 12-mm probes, the 3.3-mm probes were cleaned and disinfected for reuse. All images were reviewed by two blinded readers for the presence of thrombus or dense spontaneous echocontrast.

RESULTS

Baseline Patient Characteristics

Of the patients, 65% were male and 35% were female. The causes of the atrial arrhythmia varied, including hypertension (28%), coronary artery disease (22%), dilated cardiomyopathy (17%), mitral stenosis (7%), and other valvular disease in (5%). Fifteen percent had postoperative atrial fibrillation. One each had lone atrial fibrillation, a previously unknown atrial septal defect, hyperthyroidism, and alcohol withdrawal.

Images

The esophagus was intubated with both probes in all 60 patients without complication. Good esophageal contact was obtained in all patients. In 51 patients (85%), the LA and LAA were well visualized with the 3.3-mm probe. Thrombus was absent on both studies in 43 of the 51 patients in whom visualization was good. A thrombus or dense, slow-moving spontaneous echocontrast was seen in 7 patients on both studies. Of these, 6 included PW of the appendage and in all the peak antegrade velocity was less than 25 cm/s. In the final patient with adequate visualization of the LAA, dense, slow-moving spontaneous contrast was seen with the 3.3-mm probe but not with the 12-mm probe (sensitivty 100%, specificity 97%, overall concordance 98%). In 9 of 60 patients (15%) the LAA could not be assessed because of an inability to visualize it in the monoplane view or as a result of beam divergence and loss of image quality. Patients for whom the LAA could not be adequately visualized tended to have a leftward deviation of the LAA relative to the vertical TEE scan plane, more commonly seen in obese patients and those with severely dilated chambers in our study. The right atrium was visualized in a bicaval view in all studies and no right atrial thrombi were detected on either study. Attempts were not made to view structures in an orthogonal plane because of difficulty fulling flexing the probe once it was in the esophagus and to avoid the potential of esopageal perforation. Incidentally, other anatomic features that were well visualized by 2-dimensional and color Doppler included the atrial septum and the mitral valve. Four patients were noted to have an interatrial flow communication by color flow Doppler on both studies.

DISCUSSION

This study has two major findings that could potentially impact patient comfort and cost in the management of atrial fibrillation. First, we found that a readily available miniature echocardiographic probe initially designed for intracardiac imaging could be comfortably and effectively used to image the LA for the presence of thrombus in a substantial portion of patients. As the cross-sectional area of the 3.3-mm probe is less than 1/10 that of a traditional 12-mm probe (0.09 vs 1.1 cm^2), the ease of passage and patient tolerance seen in our study was not surprising (Figure 1). The small size allowed for performance of the procedure using only topical anesthetic, obviating the need for sedation and associated support personnel and facilities.

Secondly, we identified a clinical approach for using the currently available 3.3-mm monoplane probe, and technical modifications that would need to be implemented to effectively image a greater proportion of patients. With current technology, we suggest initial imaging with the 3.3-mm probe with topical anesthesia alone. For the 15% of patients in whom the LAA cannot be easily and clearly seen, traditional TEE should subsequently be used. As the miniature probe

Figure 1 Standard 10-mm omniplane (*left*) and 3.3-mm monoplane (*right*) probes.