

# Safety of Inoue Balloon Mitral Commissurotomy in Patients With Left Atrial Appendage Thrombi

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**B**alloon mitral commissurotomy (BMC) has been contraindicated in the presence of left atrial (LA) thrombus.<sup>1</sup> Before the advent of transesophageal echocardiography (TEE), detection of LA thrombi depended solely on the use of transthoracic 2-dimensional echocardiography. Because this modality is insensitive in detecting LA appendage thrombi,<sup>2</sup> BMC had been performed in some patients with unsuspected appendage thrombi. As TEE improves the diagnostic accuracy of the appendage thrombi, the issue arises as to whether patients with such thrombi should be denied the potential benefits of BMC and undergo mitral valve surgery instead. Limited experience by Chen et al<sup>3</sup> and our preliminary studies<sup>4</sup> suggested the feasibility of

BMC in such patients. The present study of Inoue BMC in a large number of these patients confirms the safety of the procedure.

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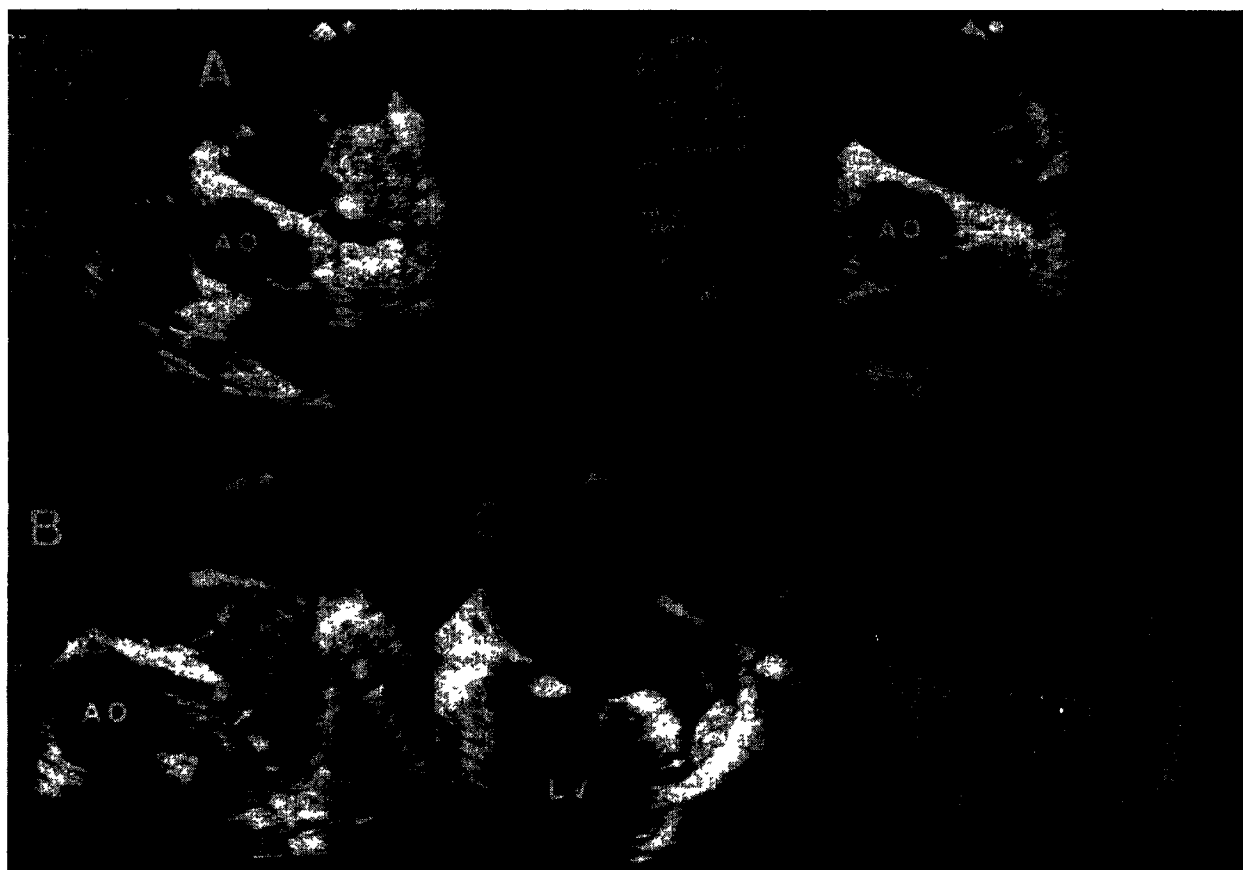
Between April 1990 and December 1993, of the 468 patients who underwent TEE (biplane or omniplane transducer, Hewlett-Packard, Andover, Massachusetts) examination before BMC, 66 (15 men and 51 women,

**TABLE I** Patient Groupings by Echocardiographic Findings

	TTE	TEE	Warfarin
Group 1 (n = 17)	Thrombi (+) initially, thrombi (-) at F/U	Appendage thrombi (+), after thrombi (-) by TEE	3-12 months
Group 2 (n = 7)	Thrombi (-)	Appendage thrombi (+) extending to cavity, thrombi confined to appendage at F/U	3-12 months
Group 3 (n = 42)	Thrombi (-)	Appendage thrombi (+)	≥6 weeks (n = 36) No (n = 6)

F/U = follow-up at 3 month intervals with warfarin, TEE = transesophageal echocardiography, TTE = transthoracic echocardiography, (+) = present, (-) = absent

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**FIGURE 1.** A, left panel, a large left atrial appendage thrombus extending to the cavity (arrows); right panel, partially resolved thrombus (arrows) is now confined to the appendage after 12 months of warfarin treatment. B, C, and D, thrombi of different sizes and shapes, confined to the left atrial appendage (white arrows) (note also black arrow in D). AO = aorta; LV = left ventricle.

aged 25 to 66 years [mean 46]) had thrombi confined to the LA appendage (Table I, Figure 1). Of these 66 patients, 63 had atrial fibrillation (representing 19% of 326 patients with atrial fibrillation), and 3 were in sinus rhythm (2 with a history of paroxysmal atrial fibrillation). Seventeen patients had LA cavity thrombi resolved after 3 to 12 months of warfarin therapy (group 1), as observed by transthoracic echocardiography at 3-month intervals. Seven patients had LA appendage thrombi extending to the cavity, but they resolved partially and were confined to the appendage after 3 to 12 months of warfarin therapy, as observed by serial TEE at 3-month intervals (group 2) (Figure 1A). The remaining 42 patients (group 3) were shown to have appendage thrombi the day before or on the day of BMC. In groups 1 and 2, TEE was performed within 2 weeks before admission for BMC. In group 3, 36 patients had also received warfarin for  $\geq 6$  weeks. The other 6, in whom urgent BMC was performed after exclusion of cavity thrombi by TEE,

received only intravenous heparin. All warfarin treatment was discontinued several days before BMC and was substituted with intravenous heparin. With the technical precautions undertaken (described in Figure 2), Inoue BMC was performed using the stepwise dilatation technique.<sup>1</sup> There were no embolic complications.

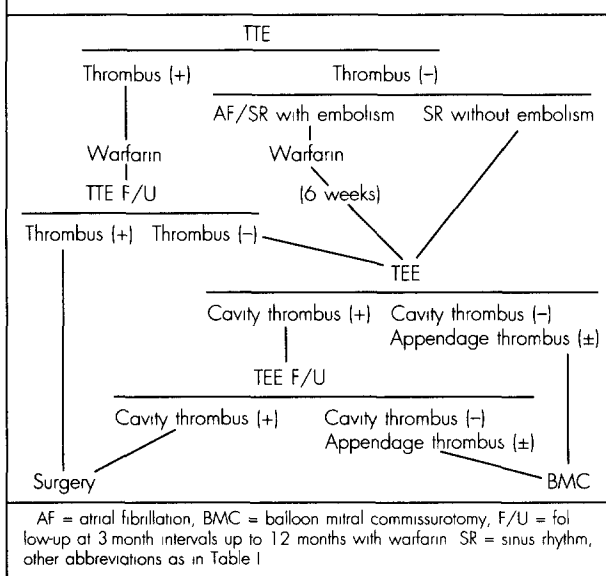
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The present study extended our 2 previous investigations<sup>4</sup> of the feasibility and safety of BMC in patients with LA appendage thrombi. The first involved 23 patients who had coronary neovascularization, a specific sign for LA appendage thrombi.<sup>5</sup> BMC in these patients was complicated by 1 systemic embolism. Whether the embolism was due to dislodgment of the thrombus is not known. The second included 7 patients (5 with appendage thrombi) in whom BMC was performed under intraoperative biplane TEE. That study confirmed that contact of the guidewire or balloon catheter with the LA appendage can be avoided. The present study has pro-



**FIGURE 2.** Manipulation of Inoue balloon catheter under 30° right anterior oblique view to avoid trespassing the left atrial appendage area (open arrow). Prior to this, the catheter is introduced under frontal view to the left atrium over a coil-tipped guidewire to form a large loop with the catheter tip medial to the mitral orifice. At all times, the balloon catheter is kept to the left of a reference pigtail catheter in the left ventricle. 1 (top), balloon catheter placed deep in the left atrium forms a large loop. In the lateral view (not shown), the loop is directed posterolaterally away from the appendage. 2 (top), a spring-wire stylet (black arrow) is inserted into the tip of the balloon catheter. 3 (top), by withdrawing the catheter and applying a counterclockwise twist to the stylet, the partially inflated balloon is directed to the mitral orifice, and then advanced to the left ventricle while the stylet is simultaneously withdrawn slightly. 1 (bottom), to remove the catheter from the left ventricle after each balloon inflation procedure, the stylet is advanced halfway into the balloon segment for better control of the catheter tip direction. 2 (bottom), the balloon catheter, with its tip directed posteriorly with a slight clockwise twist to the stylet, is withdrawn to the left atrium. 3 (bottom), the catheter, after having been withdrawn from the left ventricle, stands fairly straight up without looping. For the next crossings of the mitral valve, the stylet is inserted into the catheter tip to bend the catheter downward into an arch, while extra care is taken to keep the catheter to the left of the pigtail catheter (not shown).

**TABLE II** Echocardiography-Based Decision-Making Algorithm for BMC



vided direct evidence supporting the safety of BMC in patients with LA appendage thrombi.

It is our current policy to perform TEE just prior to BMC, after exclusion of LA thrombi by transthoracic echocardiography (Table II). If TEE reveals no cavity thrombi, BMC is then performed regardless of the presence of appendage thrombi. However, TEE is performed after 6-week warfarin treatment in elective BMC candidates with atrial fibrillation or with a history of systemic embolism. Patients in sinus rhythm without embolic history undergo BMC upon exclusion of cavity thrombi by

TEE with no warfarin pretreatment, as do those needing urgent BMC.

If initial transthoracic echocardiography shows LA thrombi, and if the patient's clinical and hemodynamic status does not warrant immediate surgery, long-term warfarin treatment is initiated and TEE is deferred until thrombus resolution as observed by transthoracic echocardiography at 3-month intervals according to the thrombus resolution study protocol<sup>4</sup>. When TEE confirms the absence of thrombi in the LA cavity, patients are admitted for BMC. Otherwise, warfarin is continued and TEE is repeated at 3-month intervals.

**In conclusion, with proper care it is safe for experienced operators to perform Inoue balloon BMC in patients with LA appendage thrombi. There are 2 alternatives: either subject patients to mitral valve surgery or defer BMC for stable patients until resolution of the appendage thrombi after warfarin treatment.<sup>6</sup>**

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## Prevalence of Extracranial Carotid Arterial Disease and of Valvular Aortic Stenosis and Their Association in the Elderly

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**V**alvular aortic stenosis<sup>1-4</sup> and extracranial carotid arterial disease (ECAD)<sup>5</sup> have a high prevalence in elderly patients and similar predisposing factors<sup>5,6</sup>. Although the prevalence of ECAD and of valvular aortic stenosis are known in elderly patients,<sup>1-5</sup> the association between these 2 disorders needs investigation. We performed a prospective study to determine the prevalence and severity of valvular aortic stenosis by Doppler echocardiography and the prevalence and severity of ECAD by bilateral carotid duplex ultrasonograms and

their association in patients  $\geq 60$  years of age in a long-term health care facility.

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Technically adequate bilateral carotid duplex ultrasonograms and continuous-wave Doppler recordings for determining the prevalence and severity of valvular aortic stenosis were obtained prospectively in 1,275 patients (906 women and 369 men, mean age  $81 \pm 8$  years [range 60 to 101]) in a long-term health care facility. Bilateral carotid duplex ultrasonograms were obtained as previously described with an Interspec XL machine using a 7.5 MHz transducer with combined 2-dimensional, real-time, and pulsed or high-pulse frequency Doppler capabilities.<sup>5</sup> The severity of internal or common carotid atherosclerotic obstruction was semiquantified by using conventional Doppler criteria: maximal velocity ( $V_{max}$ )  $< 0.8$  m/s =  $< 40\%$  arterial luminal diameter reduction;  $V_{max}$  0.80 to 1.75 m/s = 40% to 80% reduction;  $V_{max}$

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