All patients tolerated the procedure well, with minimal discomfort. In the retrograde aortic group, 1 patient had a large hematoma at the site of the arterial puncture, and another had ventricular fibrillation related to a sudden impedance increase during the successful radiofrequency ablation attempt. After ablation, patients were treated with aspirin (325 mg/day for 1 month).

Radiofrequency ablation of left free wall accessory pathways using either a retrograde aortic or transseptal approach has been very effective. Using a conservative approach generally limiting fluoroscopy time to 60 minutes, the transseptal approach provided a slightly better success rate than did the retrograde aortic approach. Mean fluoroscopy time and number of attempts necessary to achieve successful ablation did not differ. Furthermore, 2 clinical recurrences of tachycardia were observed with the aortic approach, whereas no recurrences were observed in the transseptal group. We conclude that both techniques are comparable, and choice depends on operator preference and experience. With the retrograde aortic approach, the ablation catheter is placed beneath the mitral valve leaflet on the ventricular aspect of the annulus, and the recorded electrogram is mainly characterized by a small atrial and a large ventricular electrogram (Figure 1).[1,3-4] The atrial electrogram and the pathway potential may be difficult to see during ventricular pacing or reentrant tachycardia, as required for concealed pathways. It is also technically more difficult to map the subvalvular region in a systematic way, and some locations may be difficult to access. The atrial side of the annulus can be mapped with the retrograde aortic approach, but this is difficult, and catheter stability is a problem.

With the transseptal approach, the catheter is advanced to the atrial side of the mitral valve, and in general, good atrial and ventricular electrograms are seen (Figure 2).[2] It is much easier to see the atrial electrogram during ventricular pacing and reentrant tachycardia. Consequently, we prefer this approach for unidirectional retrograde pathways. Systematic mapping of the atrioventricular annulus is generally easier and faster with this approach. It can be difficult to maintain catheter stability for anterolateral pathways, where the catheter tends to fall into the left atrial appendage.

In conclusion, both the transseptal and aortic methods are comparable, and priority depends on operator preference. It is useful to be familiar with both techniques to allow an alternate approach in difficult cases.

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Doppler Detection of Valvular Regurgitation After Radiofrequency Ablation of Accessory Connections

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Radiofrequency current was used recently to ablate accessory connections in patients with supraventricular tachycardia.[1-5] After locating the accessory connection by electrophysiologic mapping, ablation is achieved by positioning a 7Fr catheter (with 4 mm electrode at distal tip) within the ipsilateral cardiac chamber and adjacent to the accessory connection. Radiofrequency current is then delivered at the point of earliest electrical activation along the atrioventricular valve annulus. For a left-sided accessory connection, the catheter is usually passed retrograde across the aortic valve into the left ventricle and under the posterior mitral valve leaflet. For a right-sided accessory connection, the catheter is passed anterograde into the right atrium or ventricle.[1-5] Systematic evaluation of the effects of this technique on the function of all cardiac valves has not been reported. This study evaluates the effects of catheter manipulation and radiofrequency current delivery on valve competence.

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From May 1990 to December 1991, all patients undergoing radiofrequency ablation were examined prospectively with 2-dimensional, pulsed and color flow Doppler echocardiography. Echocardiograms were obtained within 1 week before and 1 week after the radiofrequency ablation procedure. Pulsed and color flow Doppler examinations of all 4 cardiac valves were performed from standard parasternal and apical views. The amount of valvular regurgitation was graded according to the following criteria: (1) mild = small, narrow jet of low amplitude detected near valve origin on color Doppler echocardiography, with confirmation by pulsed Doppler echocardiography and with normal cardiac chamber dimensions; (2) moderate = easily detected, high-amplitude jet associated with cardiac chamber enlargement; and (3) severe = wide, easily detected, high-amplitude jet with marked chamber enlargement.

During this period, 44 patients underwent 52 ablation procedures on 46 connections. Three patients (all with left-sided accessory connections) were excluded from the study because pre- and postablation echocardiographic examinations were not performed. The remaining 41

patients with 43 accessory connections (9 right, 28 left, 2 bilateral and 2 dual atrioventricular nodal) composed the study group. Patients ranged in age from 2 to 22 years (mean 12) and in weight from 16 to 98.5 kg (mean 50). Two patients had cardiac defects (1 Ebstein anomaly and 1 mitral valve prolapse).

Thirteen patients underwent ablation with the catheter at the tricuspid valve (9 right, 2 bilateral and 2 atrioventricular nodal). Current was delivered from the ventricular side of the valve annulus in 4 patients and from the atrial side in the remaining 9. Before ablation in this group, 13 patients had tricuspid regurgitation (12 mild and 1 moderate), 7 had mild pulmonic regurgitation, 4 had mild mitral regurgitation, and 1 had mild aortic regurgitation. On the postablation echocardiogram, no change in the presence or severity of regurgitation was seen for any valve.

Thirty patients underwent ablation with the catheter at the mitral valve (28 left and 2 bilateral). A retrograde aortic approach was used to deliver the current in all patients. Before ablation in this group, 22 patients had mild tricuspid regurgitation, 15 had mild pulmonic regurgitation, 6 had mild mitral regurgitation, and none had aortic regurgitation. On the postablation echocardiogram, no change in the amount of tricuspid or pulmonic regurgitation was found for any patient; however, 4 developed new mild mitral regurgitation (12% increase), and 9 developed new mild aortic regurgitation (30% increase). The development of aortic and mitral regurgitation was independent of age, weight and number of ablation attempts (using linear regression analysis, $p = 0.21$ to 0.32).

Radiofrequency ablation requires catheter manipulation across the aortic or tricuspid valve, or both, as well as delivery of a radiofrequency current to tissue near the mitral or tricuspid valve annular rings, or both.[1-5] In this study we detected a 12% increase in the incidence of mild mitral regurgitation when radiofrequency ablation was used for a left-sided accessory connection. We speculate that the new onset mitral regurgitation may result from catheter manipulation or direct tissue injury where radiofrequency current was used. A similar effect was not seen on the tricuspid valve in patients with right-sided pathways, possibly because only 4 of the 13 with right-sided connections underwent aggressive catheter manipulation to deliver the radiofrequency current from the ventricular side of the tricuspid annulus. The remaining 9 patients received only catheter placement in the right atrium, and current delivery from the atrial side of the valve. Furthermore, the mitral valve with its 2 papillary muscles subjected to systemic pressures may be more vulnerable to damage and subsequent leakage than is the tricuspid valve with its multiple papillary muscles subjected only to normal pulmonary pressures.

We observed a 30% increase in the incidence of aortic regurgitation when radiofrequency ablation was used for a left-sided accessory connection. Vigorous manipulation of the ablation catheter to position the distal tip properly may directly damage the aortic valve leaflets. Furthermore, prolonged placement of the catheter across the active valve leaflets may cause stretching or compression of leaflet tissue, and subsequent valvular incompetence. This experience underscores the importance of minimizing manipulation of the ablation catheter across the aortic valve, and suggests that the transseptal approach should be considered if prompt catheter placement and ablation are not achieved.

Although long-term results are unknown, these findings of new onset mitral and aortic regurgitation warrant further investigation and follow-up studies. Regardless of the catheter approach used, the effects of radiofrequency ablation on valve competence can be readily examined with Doppler echocardiography. Therefore, we recommend that a Doppler echocardiogram be obtained in all patients who have undergone radiofrequency ablation of a left-sided accessory connection.

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Safety of Percutaneous Transvenous Balloon Mitral Commissurotomy in Patients with Mitral Stenosis and Thrombus in the Left Atrial Appendage

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Percutaneous transvenous mitral commissurotomy (PTMC) is an effective therapeutic alternative for patients with symptomatic mitral stenosis (MS).[1-4] Left atrial thrombus occurs frequently in MS and is generally considered as a contraindication to PTMC.[1-4] Since the introduction of transesophageal echocardiography, even a small thrombus confined to the left atrial appendage can be detected.[5,6] Whether such patients should be denied the potential benefits of PTMC and be subjected to mitral valve surgery is an issue of clinical interest. To our knowledge, there have been few studies of PTMC in

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