conduction with relapse, and class I drugs such as flecainide may accelerate response at the time of relapse. Antiarrhythmic drugs other than sotalol, dronedarone, or amiodarone should therefore be combined with a rate control agent such as a β-blocker or nondihydropyridine calcium-channel blocker during long-term therapy. Figure 9-7 is a proposed strategy for antiarrhythmic drug selection for the long-term maintenance of sinus rhythm in patients with AF.

Surgical Ablation of Atrial Fibrillation

The surgical treatment of AF was pioneered by Cox with the development of the atrial maze procedure. The procedure was predicated on the concept that AF was maintained by multiple interacting wave fronts of activity. By surgically dividing the atria into narrow channels, most with connection back to the sinus node, it was thought that AF could be abolished while preserving physiologic activation and contraction of the atrium. The circuitous path left for atrial activation and the multiple barriers created in the atrium intended to prevent AF gave rise to the term *maze procedure* to describe the technique. The initial procedure was thought to be highly successful but was associated with significant surgical risks and problems with sinus node dysfunction. Because of the surgical complexity of making and then closing multiple incisions in the atria and the complications associated with the procedure, the initial cut-and-sew maze procedure has fallen out of clinical use.

Although the original maze procedure is no longer used, many techniques have been developed to simplify the operation by substituting linear thermal ablation (by heating or cooling tissue) to create lines of conduction block in the atria without the need for extensive atrial dissection and reconstruction. Surgical ablation is commonly applied in patients with a history of AF who are undergoing concomitant heart operations for other indications such as valvular or coronary disease. Less frequently, surgical ablation has been applied as a stand-alone procedure for the sole management of AF. In that setting, various minimally invasive techniques have been developed. However, the techniques used vary widely from one center to another and long-term reporting of outcomes is inconsistent. In a large series that included 282 patients undergoing an open bi-atrial ablation procedure, 78% were in sinus rhythm without antiarrhythmic therapy at the 1 year follow-up evaluation.

Another important potential benefit of surgical ablation for AF is that it provides an opportunity to eliminate the left atrial appendage as a potential site of thrombus formation and source of thromboembolism. This can be accomplished by complete amputation of the appendage with oversewing of the appendage or clamping off the opening to the appendage with special devices designed for this purpose. This may be especially important in patients with absolute or relative contraindications to anticoagulation.

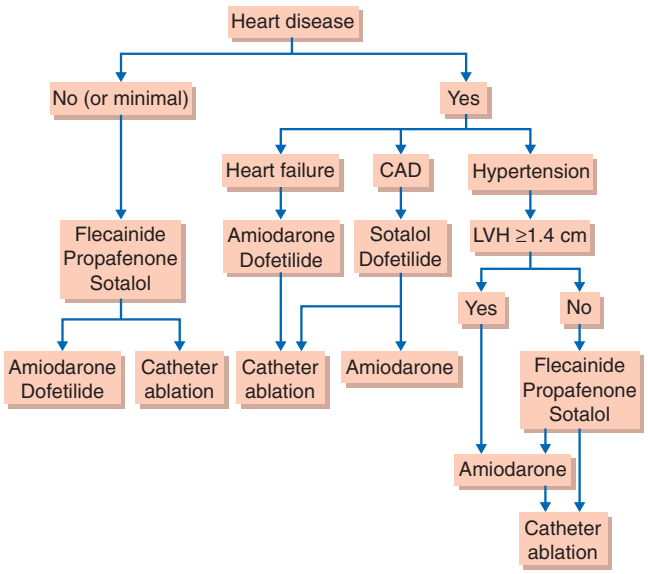

FIGURE 9-7 A strategy for the selection of therapy to maintain sinus rhythm in patients with recurrent atrial fibrillation. Patients are stratified by the presence of absence of structural heart disease, and drugs expected to have the greatest efficacy and lowest therapeutic risk in each group are selected. Catheter ablation becomes a therapeutic option after failure of at least one antiarrhythmic drug. The class 1C drugs flecainide and propafenone are not advised for patients with heart failure or coronary artery disease (CAD). Amiodarone is an acceptable first-line drug for those with heart failure and severe left ventricular hypertrophy. Because of its potential for somatic toxicity, amiodarone is otherwise reserved as a second-line agent that is used as an alternative to catheter ablation.

Catheter Ablation of Atrial Fibrillation

Catheter ablation has become a common procedure for the management of AF after failure of initial attempts at medical therapy of AF. Initial attempts to cure AF using catheter techniques were based on attempts in the early 1990s to emulate the linear lesion set of the Cox maze procedure with multiple endocardial lesions. High complication rates and limited efficacy led to abandonment of this approach.

In 1998, Haissaguerre reported the important role of rapid activity originating in the musculature of the pulmonary veins in initiation of paroxysmal AF. This led to the development of procedures designed to target the pulmonary veins and eventuated in the technique of electrical pulmonary vein isolation (PVI), which is currently the primary ablative approach to treatment of paroxysmal AF by catheter techniques. This technique has had acceptably high success rates (≈70%) at multiple centers for the treatment of paroxysmal AF without antiarrhythmic therapy.

Despite the high success rate of catheter PVI ablation for the treatment of paroxysmal AF, this technique has not proved reliably effective in the management of more persistent forms of AF, especially long-standing persistent AF. This likely reflects the importance of factors other than pulmonary vein activity in the initiation and maintenance of persistent AF that are not addressed by PVI ablation. Multiple ablative techniques are currently used in an attempt to increase the success rates for patients with persistent AF. They have included addition of linear lesions to block reentrant wave fronts, ablation of regions of unusually rapid atrial activity during ongoing AF, and interruption of stable rotors of atrial activity identified during multisite mapping of AF. Although these techniques have improved success rates in limited series, it is uncertain which, if any, of these methods represents the optimal approach to the ablation of long-standing persistent AF.