have been effective in increasing the rate of early conversion of AF. Pharmacologic conversion usually is more successful with AF of recent onset than with chronic AF.

Oral agents with efficacy in the early conversion of AF include flecainide, propafenone, and dofetilide. Oral amiodarone and sotalol have been associated with a 27% and 24% conversion rate, respectively, occurring after 28 days of therapy. However, due to low early conversion rates, these oral drugs are not recommended for conversion. Intravenous agents with efficacy for early conversion include ibutilide and amiodarone. Ibutilide is limited by a relatively high 4% rate of drug-induced QT prolongation and TdP VT. This risk is even higher in the setting of LV dysfunction, electrolyte disturbances, or heart failure. Ibutilide should be reserved for the pharmacologic conversion of stable patients with a baseline normal QT interval. In contrast, intravenous amiodarone is well tolerated by unstable patients and is the preferred pharmacologic agent for conversion in the critically ill.

Electrical Cardioversion of Atrial Fibrillation

Electrical cardioversion should be performed urgently in the case of severe compromise related to acute AF, including angina, heart failure, hypotension, and shock. Cardioversion should also be attempted at least once electively in most cases of new-onset AF regardless of tolerance. When performing electrical cardioversion, an anterior-posterior patch or paddle position is more effective than the conventional anterior-to-lateral patch or paddle position used for ventricular defibrillation. Although low-output discharges may be effective in some patients, a strategy of starting at higher outputs decreases the number of shocks required and the average cumulative energy delivered. An initial shock energy of 200 J is recommended. After a failed initial shock, full output should be used for the next attempt.

Long-Term Maintenance of Sinus Rhythm

Antiarrhythmic Therapy

Despite the association of AF with an increase in stroke-related and all-cause mortality, no study has established a benefit for pharmacologic maintenance of sinus rhythm in terms of stroke risk or survival. This may be because AF is merely a marker and not a mechanism of mortality. It may also be a consequence of the relative inefficacy of pharmacologic therapy in the maintenance of sinus rhythm and the difficulty establishing whether patients thought to be in sinus rhythm are consistently in sinus rhythm at follow-up.

The largest and best designed trial addressing this issue was the Atrial Fibrillation Follow-up Investigation of Rhythm Management (AFFIRM) trial. The study included 4060 patients randomly assigned to rhythm control with antiarrhythmic drugs, most commonly amiodarone, or to rate control without attempts to maintain sinus rhythm. AFFIRM demonstrated no advantage in stroke or mortality rates using a strategy of sinus rhythm maintenance compared with rate control. Either strategy can be offered to patients with an expectation of similar outcomes with regard to hard end points. The decision to pursue sinus rhythm usually is determined by the management of symptoms that may be better addressed by maintaining sinus rhythm in selected patients.

In the absence of antiarrhythmic drugs, more than 80% of patients relapse during the first year after cardioversion of AF. Antiarrhythmic drugs remain the primary strategy for maintaining sinus rhythm after cardioversion and for preventing symptomatic episodes in patients with paroxysmal AF. However, antiarrhythmic therapy has many limitations, and alternative ablative therapies may over time overtake antiarrhythmic therapy in the management of AF.

All antiarrhythmic drugs have the potential for proarrhythmia, the unintended precipitation of a new arrhythmic problem caused by the drug. Adverse rhythm effects of drugs may include sinus node dysfunction, heart block, promotion of drug-slowed atrial flutter permitting rapid 1 : 1 conduction, and promotion of potentially lethal ventricular arrhythmias. Class I drugs such as flecainide, propafenone, and disopyramide may result in significant direct myocardial depression and consequent exacerbation of heart failure. The array of potential adverse effects of antiarrhythmic drugs is beyond the scope of this chapter, but certain essential concepts are important to recognize.

Class I drugs such as flecainide and propafenone, which work by slowing conduction, have a high risk of ventricular proarrhythmia and potential for sudden death in the setting of heart failure, LV dysfunction, and coronary artery disease. Use of these drugs is restricted to patients with preserved cardiac function and no evidence of obstructive coronary artery disease. However, in this selected group of patients with normal hearts, these drugs are exceedingly safe, well tolerated, and often effective.

Class III drugs, which prolong repolarization and refractoriness, include sotalol, dofetilide, dronedarone, and amiodarone. They are safe for patients with coronary artery disease, and in the case of dofetilide and amiodarone, they are safe for those with congestive heart failure. However, sotalol and dofetilide may provoke TdP, even in patients with normal cardiac function, and they must be used with caution. Amiodarone has greater long-term efficacy than other drugs and a lower risk of proarrhythmia, but long-term somatic toxicity consisting of thyroid dysfunction, pulmonary, and occasional hepatotoxicity limits the use of this drug in older patients or those with limited expected longevity or an inability to safely tolerate alternative agents due to advanced cardiac disease or proarrhythmia. Amiodarone is highly effective for the short-term, acute management of arrhythmias in critically ill patients when the potential risk of long-term toxicity is not an issue.

Dronedarone, which was approved in 2009, was derived by modification of the amiodarone molecule. Like amiodarone, the drug has a low risk of proarrhythmia and TdP VT. Unlike amiodarone, the drug does not cause thyroid toxicity. In common use, hepatotoxicity is also uncommon with dronedarone. However, rare cases of hepatic failure have been associated with dronedarone use. Dronedarone has increased mortality rates for patients with recently decompensated heart failure and when used as a simple rate control agent in patients with permanent AF. It is contraindicated in these settings.

In addition to being useful agents for the prevention of AF, sotalol, dronedarone, and amiodarone provide substantial rate control during relapses of AF. However, rate control with other antiarrhythmic agents may not be adequate to prevent rapid