Electrical and Pharmacologic Cardioversion for Atrial Fibrillation

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KEYWORDS

• Atrial fibrillation • Cardioversion • Electrical

Cardioversion is a useful tool in managing patients who have atrial fibrillation (AF) when rhythm control is appropriate. It is used most frequently for those who are symptomatic or newly diagnosed. Transthoracic electrical cardioversion is the overwhelmingly preferred method because of its relative simplicity and efficacy, even in patients who have multiple comorbid conditions and significant structural heart disease. In selected circumstances, pharmacologic cardioversion is preferred. This article discusses indications for cardioversion and management of pericardioversion anticoagulation and describes electrical and pharmacologic cardioversion in detail. Finally, management strategies are offered for initial failure to convert or immediate recurrence of AF (IRAF).

PATTERNS OF ATRIAL FIBRILLATION

Before discussing the indications for cardioversion, it is useful to define the clinical patterns of the occurrence of AF. Generally, patients who have AF demonstrate one of three clinical patterns: paroxysmal, persistent, or permanent AF (**Fig. 1**).[1] Paroxysmal AF consists of self-terminating episodes, each usually lasting fewer than 7 days and often less than 24 hours. Persistent AF consists of non–self-terminating episodes, each lasting more than 7 days, whereas permanent AF is defined as a long episode with failed or no attempt at cardioversion.

Given these definitions, cardioversion can be clinically useful in some patients who have paroxysmal AF and in many who have persistent AF. By definition, cardioversion is not used for patients who have permanent AF.

INDICATIONS FOR CARDIOVERSION

Broadly, cardioversion should be considered for two populations of patients: those who are symptomatic with AF and those who present with AF for the first time.

Patients who have symptomatic AF can have severe enough symptoms, such as severely decompensated heart failure, hypotension, uncontrolled ischemia, or angina, to mandate urgent cardioversion. Other patients who have AF may have less severe symptoms, such as palpitations, fatigue, lightheadedness, and exertional dyspnea. Regardless of the degree of severity, any symptoms caused by atrial fibrillation warrant consideration of cardioversion as a management option.

Restoration of sinus rhythm is a reasonable goal in patients who have a first-time diagnosis of AF, regardless of symptoms, unless some indication shows that the AF has been present for many years before identification. The purpose of cardioversion, even in patients who are asymptomatic or newly diagnosed, is to slow the progression of the clinical pattern of AF. Many lines of evidence support the principle that "atrial fibrillation begets

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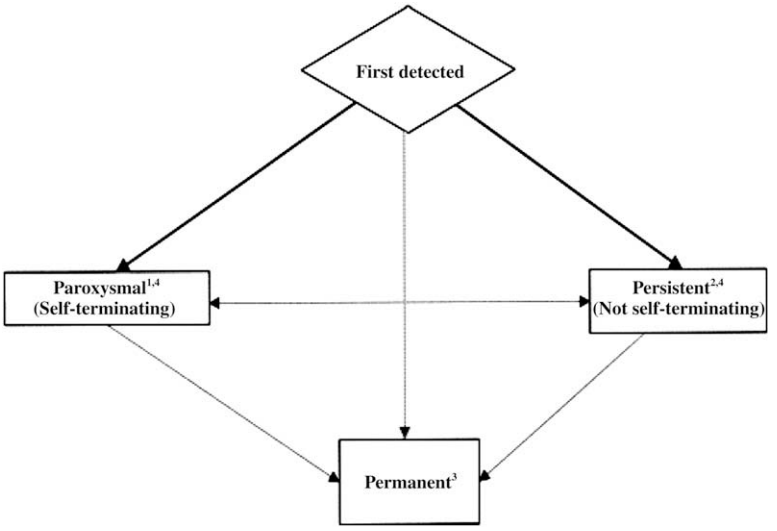

Fig. 1. Patterns of AF. (1) Episodes that last generally 7 days or fewer (most less than 24 hours); (2) episodes that last usually longer than 7 days; (3) cardioversion failed or not attempted; and (4) paroxysmal and persistent AF may be recurrent. (*From* Fuster V, Ryden LE, Cannom DS, et al. ACC/AHA/ESC 2006 guidelines for the management of patients with atrial fibrillation. Circulation 2006;114:e257–354, © 2006; with permission from the American Heart Association.)

atrial fibrillation''.[2] Natural history studies show that AF can be a progressive disease: patients who have paroxysmal AF progress to persistent and permanent AF. Even those who have lone paroxysmal AF may progress,[3] and the tendency to progress seems to correlate with the duration of the paroxysmal AF episodes.[4]

In addition, many clinical trials show that pharmacologic and electrical cardioversion are more likely to succeed in patients experiencing shorter episodes.[5] A study comparing short- versus longer-duration episodes of AF in goat hearts showed that with longer-duration episodes, the rate, inducibility, and stability of AF increased significantly. In addition, a marked shortening of the atrial effective refractory period was seen.[2] These lines of evidence strongly support the principle that AF begets itself; this principle underlies the rationale for cardioverting patients who have newly diagnosed AF.

As evidenced in large-scale, randomized clinical trials, repeated cardioversion and other attempts to maintain sinus rhythm are unlikely to have a meaningful clinical impact on older patients who are asymptomatic. Also, by definition, cardioversion is not applied to patients who have permanent AF. Both populations of patients, however, should undergo therapeutic anticoagulation or antiplatelet therapy as dictated by their risk for a thromboembolic event versus the risks from this therapy.[6,7]

Another group of patients who may benefit from cardioversion are those who have postoperative AF. Postoperative AF occurs most commonly in the first few days after surgery, when anticoagulation may be undesirable. Many episodes of postoperative AF resolve spontaneously. Patients who do not experience spontaneous resolution may be cardioverted before an AF duration of 48 hours to avoid anticoagulation.

RATE OF SUCCESSFUL CARDIOVERSION

With electrical cardioversion and use of biphasic waveforms, cardioversion success rates are consistently at or greater than 90%.[8,9] These high rates of successful cardioversion apply even in populations of patients who have advanced age, multiple comorbid conditions, and significant structural heart disease. In one study of 1355 patients who had persistent AF (>7 days) undergoing electrical cardioversion,[8] 92% were successfully converted to sinus rhythm. With biphasic energy cardioversion, multivariate analysis showed that no patient characteristic, gender, age, comorbid condition, or cardiac structural abnormality (eg, reduced left ventricular ejection fraction, enlarged left atrium, other structural heart disease) was associated with failure to convert to sinus rhythm. Therefore, although these baseline characteristics should be considered with regard to successful maintenance of sinus rhythm, they should not necessarily deter attempts at cardioversion.

PERICARDIOVERSION ANTICOAGULATION

AF results in mechanical stasis in the atria and is associated with a proinflammatory and therefore potentially prothrombotic state.[10] Therefore, patients who have AF are at risk for developing intracardiac thrombi and subsequent embolization. The risk for a thromboembolic event is particularly high around cardioversion for two reasons. First, if an unstable thrombus is present precardioversion,