Managing chronic atrial fibrillation:
Strategies to control symptoms and prevent embolism

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Even though atrial fibrillation (AF) is the most common sustained cardiac arrhythmia seen in clinical practice, no consensus has been reached on how best to manage it. However, by focusing management on two goals—controlling patient symptoms and preventing systemic embolism—clinicians can make rational therapy choices for individual patients with AF. This review briefly surveys strategies to achieve these goals, along with related issues in the management of chronic AF.

ESSENTIALS OF THE EVALUATION

Recent guidelines on AF management from the American College of Cardiology, American Heart Association, and European Society of Cardiology (ACC/AHA/ESC)[1] outline the principles for assessing patients with known or suspected AF. At minimum, the clinician should:

- Take a history and conduct a physical examination with an eye toward defining the nature of symptoms and detecting underlying heart disease or other reversible conditions, such as hyperthyroidism or excessive alcohol consumption
- Obtain an electrocardiogram to verify AF, exclude prior myocardial infarction, assess ventricular rate, and measure the QRS and QT intervals if antiarrhythmic drug therapy is considered
- Order a chest radiograph when the clinical findings suggest a pulmonary abnormality
- Obtain an echocardiogram to assess valvular heart disease, right and left atrial size, left ventricular size and function, right ventricular pressure (pulmonary hypertension), and pericardial disease
- Order blood tests of thyroid function for patients with a first episode of AF, if the ventricular rate is difficult to control, or when AF recurs soon after cardioversion.

Additional useful testing

The following tests may also be useful in selected patients:

- Exercise testing, to assess rate control during AF, to exclude exercise-induced AF, and to exclude ischemia before treatment with type IC antiarrhythmic drugs
- Holter monitoring, to assess ventricular rate control during normal activity
- Transesophageal echocardiography, to identify left atrial thrombus and to guide cardioversion.

Once a thorough evaluation is completed, the physician is better prepared to achieve the two main goals in managing patients with AF: symptom control and prevention of systemic embolism.

SELECTING A STRATEGY FOR SYMPTOM CONTROL

Symptom control can be achieved with a strategy of rhythm control, in which the goal is to restore and maintain sinus rhythm, or a strategy of rate control, in which the goal is to control the ventricular rate during AF. Recent clinical trials have shown that both approaches are acceptable as initial strategies in most patients with AF.[2,3]

Restoring sinus rhythm

The standard approaches for converting AF to sinus rhythm are direct-current cardioversion and pharmacologic cardioversion using class IA, IC, or III antiarrhythmic drugs. Electrical cardioversion is indicated in hemodynamically unstable patients. In stable patients, either electrical or pharmacologic

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cardioversion may be tried, although at our institution we generally prefer electrical cardioversion because of its higher efficacy.

Maintaining sinus rhythm

Drug therapy. Only about 25% of patients who undergo cardioversion remain in sinus rhythm for more than 1 year without antiarrhythmic drug therapy. Treatment with an antiarrhythmic drug increases this proportion to approximately 50%.[1]

As detailed in the preceding article in this supplement, class IA, IC, and III antiarrhythmic drugs are useful for maintaining sinus rhythm. Briefly, for patients with no (or minimal) heart disease, flecainide, propafenone, and sotalol are first-line agents, with dofetilide and amiodarone as second-line options.[1] We generally avoid amiodarone in patients without structural heart disease because of its potential for toxicity with long-term use.

For patients with left ventricular dysfunction, dofetilide and amiodarone are the drugs of choice. For patients with coronary artery disease, sotalol is the drug of choice if left ventricular function is relatively preserved, whereas dofetilide and amiodarone are preferred if there is moderate or severe left ventricular dysfunction.[1]

We generally do not use class IA antiarrhythmic drugs because they are less well tolerated and have no greater efficacy than the class IC and III agents.

Notably, recurrence of AF does not necessarily mean drug failure. In fact, for most patients with AF, antiarrhythmic drugs should be viewed as tools for delaying the recurrence of AF rather than for preventing AF altogether. It is perfectly acceptable to have AF recurrences on antiarrhythmic drug therapy so long as recurrence rates are tolerable to the patient and conversion to sinus rhythm (either spontaneous or elective) occurs in a timely manner.

Nondrug therapies. Because antiarrhythmic drug therapy is often ineffective, many patients may need to be switched to a rate-control strategy or to nonpharmacologic therapies for restoring and maintaining sinus rhythm. As detailed in the preceding article, nonpharmacologic approaches include catheter ablation to isolate the pulmonary veins,[4,5] the surgical maze procedure or related operations,[6,7] and implantation of an atrial defibrillator.[8] Additionally, for patients with AF who require pacemaker implantation, the physician can choose a pacemaker with pacing algorithms that help prevent AF.[9,10]

Because of the risk of procedure-related stroke and pulmonary vein stenosis, we generally reserve catheter-based pulmonary vein isolation for patients with symptomatic AF refractory to multiple antiarrhythmic drugs. For patients with AF undergoing open heart surgery for another reason (eg, valve repair or replacement), a concurrent maze-type procedure should be considered.[11] In the occasional patient, implantation of an atrial defibrillator can enhance patient autonomy and satisfaction by allowing the patient to initiate his or her own defibrillation.

Rate control

The ventricular rate may be controlled during AF by giving medications that slow atrioventricular nodal conduction. Such agents work by one of three main physiologic mechanisms:

- Calcium channel blockade (with verapamil or diltiazem)
- Reduction of sympathetic tone (with beta-blockers)
- Enhancement of parasympathetic tone (with a vagotonic drug such as digoxin).

In patients with preserved left ventricular function, rate control can generally be achieved with a beta-blocker, a calcium channel blocker, or both. In patients with reduced left ventricular function, a beta-blocker, digoxin, or both should be used for rate control. Amiodarone may also be used as a rate-controlling drug in patients with left ventricular dysfunction.

If pharmacologic rate control fails because of symptoms or side effects, consider nonpharmacologic rate control or switching to a rhythm-control strategy. The primary nonpharmacologic method of ventricular rate control is to ablate the atrioventricular node and implant a permanent pacemaker.[12] Although this approach is aggressive, it is generally quite effective in enhancing quality of life.[13]

Rhythm control vs rate control

Until recently, rhythm control was preferred over rate control for patients presenting with their first few episodes of AF. Because AF was associated with increased mortality and stroke rates, it was natural to assume that restoring sinus rhythm would not only reduce symptoms but also reduce the risk of death and stroke. However, the recent Atrial Fibrillation Follow-up Investigation of Rhythm Management (AFFIRM)[2] demonstrated that embolic events occur with equal frequency regardless of whether a rate-control or rhythm-control strategy is used. Moreover, the study found a trend toward reduced mortality with rate control as opposed to rhythm control (haz-

TABLE 1
Risk-based recommendations for anticoagulation in patients with chronic atrial fibrillation

Patient features	Antithrombotic therapy
Age < 60 years; no heart disease (lone atrial fibrillation)	Aspirin (325 mg/day) or no therapy
Age < 60 years; heart disease but no risk factors for stroke*	Aspirin (325 mg/day)
Age ≥ 60 years; no risk factors for stroke*	Aspirin (325 mg/day)
Age ≥ 60 years with diabetes or coronary artery disease	Warfarin (INR 2–3); adding aspirin 81–162 mg/day optional
Age ≥ 75 years	Warfarin (INR ~2)
Heart failure or LVEF ≤ 35%	Warfarin (INR 2–3)
Thyrotoxicosis	Warfarin (INR 2–3)
Hypertension	Warfarin (INR 2–3)
Rheumatic heart disease (mitral stenosis)	Warfarin (INR 2.5–3.5 or higher may be appropriate)
Prosthetic heart valves	Warfarin (INR 2.5–3.5 or higher may be appropriate)
Persistent atrial thrombus on TEE	Warfarin (INR 2.5–3.5 or higher may be appropriate)

* Risk factors for stroke are heart failure, LVEF ≤35%, and hypertension.
INR = international normalized ratio; **LVEF** = left ventricular ejection fraction; **TEE** = transesophageal echocardiography

ard ratio 0.87). There was no difference between the two strategies in patients' quality of life or functional status. Similar findings were reported in the Rate Control versus Electrical Cardioversion for Persistent Atrial Fibrillation (RACE) trial.[3] Both studies showed that embolic events occur most often after warfarin therapy is stopped or when the international normalized ratio is subtherapeutic. Thus, both rate control and rhythm control are acceptable approaches and both generally require anticoagulation.

■ PROGRESS IN PREVENTING EMBOLISM

The incidence of systemic embolism is about 5% per year in patients with chronic AF who are not receiving an anticoagulant.[14] The risk of stroke increases dramatically with advanced age. Other risk factors for stroke include diabetes, hypertension, previous stroke, and left ventricular dysfunction. The recent ACC/AHA/ESC guidelines[1] lay out recommendations for the use of aspirin or warfarin to minimize embolic risk in patients with chronic AF **(Table 1)**.

Transesophageal echocardiography

The ACC/AHA/ESC guidelines recommend that nonhospitalized patients who have been in AF for more than 48 hours receive 3 to 4 weeks of warfarin therapy before and after cardioversion.[1] The recommended target international normalized ratio is 2.5 (range 2 to 3). Transesophageal echocardiography (TEE)-guided cardioversion is an alternative approach that can preclude the need for prolonged anticoagulant therapy before cardioversion; if TEE reveals no atrial thrombus, cardioversion can be performed safely after only a short period of anticoagulation. If TEE reveals a thrombus, the patient should receive anticoagulant therapy for at least 3 weeks before cardioversion is performed. Whether a repeat TEE is required to confirm thrombus dissolution remains controversial.

The Assessment of Cardioversion Using Transesophageal Echocardiography (ACUTE) trial[15] compared a TEE-guided cardioversion strategy with a conventional cardioversion strategy in 1,222 patients with AF. The study found no difference between the strategies in systemic embolic events, and TEE-guided cardioversion was associated with a lower incidence of hemorrhagic events (2.9% vs 5.5%) and a higher incidence of successful restoration of sinus rhythm (71% vs 65%). The TEE-guided approach may be especially useful in patients who need to be hospitalized or who have an increased risk of bleeding during prolonged anticoagulation with warfarin.

Left atrial appendage occlusion, ligation

The left atrial appendage (LAA) is the source of a large majority of the emboli associated with AF. For this reason, LAA occlusion devices are being developed that can be implanted in the cardiac catheterization laboratory to seal the LAA in patients with chronic AF in whom anticoagulation is contraindicated.[16] Additionally, patients with AF undergoing open heart surgery can have their LAA ligated to prevent thrombus formation within the appendage. Whether LAA occlusion or ligation eliminates the need for anticoagulation requires further study.

■ INDICATIONS FOR HOSPITALIZATION

Many patients with first-detected AF are admitted to the hospital. A common reason for admission is to "rule out" acute myocardial infarction. However, AF is rarely the sole manifestation of an acute coronary event, and there is no reason to admit patients for this condition unless there are other clinical grounds for suspecting an ischemic event, such as anginal chest pain or an electrocardiogram showing an acute infarct or ischemia.[17] Patients whose clinical status is uncomplicated and who are at low risk for coronary ischemia can generally be managed in the emergency room or observational unit.

■ CONCLUSIONS

Although AF can pose frustrating clinical challenges, virtually all patients with this arrhythmia can be managed successfully if the full arsenal of treatment options is available. The risk of systemic embolism can be minimized by following established anticoagulation guidelines. As a general rule, these guidelines should be followed regardless of whether a strategy of rate control or rhythm control is used. For most patients with recurrent AF, pharmacologic rate control may be tried as initial therapy. If this does not effectively control symptoms, then pharmacologic rhythm control may be tried. If this too proves ineffective, then a nonpharmacologic intervention should be considered, such as pulmonary vein isolation or atrioventricular node ablation with pacemaker implantation. As these and other nonpharmacologic therapies for AF steadily advance, we can expect that they will be used earlier and earlier in the management of patients with AF.

■ REFERENCES

1. **Fuster V, Ryden LE, Asinger RW, et al.** ACC/AHA/ESC guidelines for the management of patients with atrial fibrillation: executive summary. A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines and the European Society of Cardiology Committee for Practice Guidelines and Policy Conferences (Committee to Develop Guidelines for the Management of Patients With Atrial Fibrillation): developed in collaboration with the North American Society of Pacing and Electrophysiology. J Am Coll Cardiol 2001; 38:1231–1266.
2. **Wyse DG, Waldo AL, DiMarco JP, et al.** A comparison of rate control and rhythm control in patients with atrial fibrillation. The Atrial Fibrillation Follow-up Investigation of Rhythm Management (AFFIRM) Investigators. N Engl J Med 2002; 347:1825–1833.
3. **Van Gelder IC, Hagens VE, Bosker HA, et al.** A comparison of rate control and rhythm control in patients with recurrent persistent atrial fibrillation. N Engl J Med 2002; 347:1834–1840.
4. **Haissaguerre M, Jais P, Shah DC, et al.** Spontaneous initiation of atrial fibrillation by ectopic beats originating in the pulmonary veins. N Engl J Med 1998; 339:659–666.
5. **Marrouche NF, Dresing T, Cole C, et al.** Circular mapping and ablation of the pulmonary vein for treatment of atrial fibrillation: impact of different catheter technologies. J Am Coll Cardiol 2002; 40:464–474.
6. **Cox JL, Boineau JP, Schuessler RB, et al.** Five-year experience with the maze procedure for atrial fibrillation. Ann Thorac Surg 1993; 56:814–823.
7. **Deneke T, Khargi K, Grewe PH, et al.** Left atrial versus bi-atrial Maze operation using intraoperatively cooled-tip radiofrequency ablation in patients undergoing open-heart surgery: safety and efficacy. J Am Coll Cardiol 2002; 39:1644–1650.
8. **Cooper JM, Katcher MS, Orlov MV.** Implantable devices for the treatment of atrial fibrillation. N Engl J Med 2002; 346:2062–2068.
9. **Funck RC, Adamec R, Lurje L, et al.** Atrial overdriving is beneficial in patients with atrial arrhythmias: first results of the PROVE Study. Pacing Clin Electrophysiol 2000; 23:1891–1893.
10. **Lamas GA, Lee KL, Sweeney MO, et al.** Ventricular pacing or dual-chamber pacing for sinus-node dysfunction. N Engl J Med 2002; 346:1854–1862.
11. **Deneke T, Khargi K, Grewe PH, et al.** Efficacy of an additional MAZE procedure using cooled-tip radiofrequency ablation in patients with chronic atrial fibrillation and mitral valve disease. A randomized, prospective trial. Eur Heart J 2002 23:558–566.
12. **Williamson BD, Man KC, Daoud E, Niebauer M, Strickberger SA, Morady F.** Radiofrequency catheter modification of atrioventricular conduction to control the ventricular rate during atrial fibrillation. N Engl J Med 1994; 331:910–917.
13. **Fitzpatrick AP, Kourouyan HD, Siu A, et al.** Quality of life and outcomes after radiofrequency His-bundle catheter ablation and permanent pacemaker implantation: impact of treatment in paroxysmal and established atrial fibrillation. Am Heart J 1996; 131:499–507.
14. Risk factors for stroke and efficacy of antithrombotic therapy in atrial fibrillation. Analysis of pooled data from five randomized controlled trials. Arch Intern Med 1994; 154:1449–1457.
15. **Klein AL, Grimm RA, Murray RD, et al, for the Assessment of Cardioversion Using Transesophageal Echocardiography Investigators.** Use of transesophageal echocardiography to guide cardioversion in patients with atrial fibrillation. N Engl J Med 2001; 344:1411–1420.
16. **Nakai T, Lesh MD, Gerstenfeld EP, Virmani R, Jones R, Lee RJ.** Percutaneous left atrial appendage occlusion (PLAATO) for preventing cardioembolism: first experience in a canine model. Circulation 2002; 105:2217–2222.
17. **Shlofmitz RA, Hirsch BE, Meyer BR.** New-onset atrial fibrillation: is there need for emergent hospitalization? J Gen Intern Med 1986; 1:139–142.