

DISCLAIMER: These guidelines were prepared by the Department of Surgical Education, Orlando Regional Medical Center. They are intended to serve as a general statement regarding appropriate patient care practices based upon the available medical literature and clinical expertise at the time of development. They should not be considered to be accepted protocol or policy, nor are intended to replace clinical judgment or dictate care of individual patients.

ACUTE ATRIAL FIBRILLATION TREATMENT IN THE SURGICAL PATIENT

SUMMARY

Atrial fibrillation is a common postoperative arrhythmia and can represent a major source of morbidity and mortality. Treatment of atrial fibrillation is directed at three main objectives: controlling the ventricular response, preventing thromboembolism, and maintaining sinus rhythm. Efforts to hasten conversion of atrial fibrillation with anti-arrhythmic agents have been unsuccessful because of poor efficacy and undesired side effects; thus control of the ventricular rate remains a principal goal of therapy for patients in the intensive care unit (ICU).

RECOMMENDATIONS

- **Level 1**
 - Beta-blockade should be the first line of therapy for postoperative atrial fibrillation to achieve rapid ventricular rate control and conversion to sinus rhythm.
 - Amiodarone should be considered as an alternative therapy to beta-blockade for postoperative atrial fibrillation when the patient is hemodynamically unstable or has a known ejection fraction of < 40%. Amiodarone should be dosed as a repeatable 150mg IV bolus followed by 20mg/kg IV for 24 hours. Patients should then be converted to 200mg PO every 8 hours for the first week followed by 200mg PO every twelve hours for three weeks.
 - Digoxin, due to its delayed onset of action and ineffectiveness, should not be used for acute rate control in atrial fibrillation, but may have a role for chronic rate control.
 - All patients with atrial fibrillation of greater than 48 hours duration should be considered to receive therapeutic anticoagulation for 3 weeks before and 4 weeks after cardioversion - electric or pharmacologic – unless emergency cardioversion is indicated.
- **Level 2**
 - AV nodal blocking agents (beta-blockers, calcium-channel blockers, and digoxin) should be avoided in Wolf-Parkinson-White and other pre-excitation syndromes.
 - Immediate cardioversion with heparinization followed by 4 weeks of anticoagulation may be performed if no atrial thrombus is visualized using transesophageal echocardiography (TEE).
- **Level 3**
 - Electrical cardioversion is indicated in patients with paroxysmal atrial fibrillation and rapid ventricular response who have ECG evidence of acute myocardial infarction or symptomatic hypotension, angina, or heart failure not responsive to pharmacological measures.

INTRODUCTION

Of the supraventricular arrhythmias, atrial fibrillation (AF) is by far the most commonly encountered in the ICU and is associated with the potential for serious consequences including stroke, deterioration of underlying cardiac disease, prolonged hospital stay, and increased mortality. AF is an irregular, disorganized, electrical activity of the atria characterized by absent P waves and an irregular baseline on ECG. Supraventricular tachycardia (SVT) is common after surgery with a frequency of 4% in patients undergoing major noncardiac procedures, 3.2% in patients undergoing abdominal aortic aneurysm repair, and almost 13% in patients undergoing thoracotomy for lung cancer (1,2). AF is more common after cardiac surgery, with frequencies of 12-40% following coronary artery bypass grafting and up to 60% following valve replacement. Because of its frequency, potential morbidity, and association with increased length of stay, AF has been well-studied (1,3). Risk factors for postoperative AF include:

- increased age
- postoperative electrolyte shifts
- pericarditis
- history of preoperative AF
- atrial distention
- history of congestive heart failure
- chronic obstructive pulmonary disease (COPD)
- increased catecholamine levels
- hyperthyroidism
- diabetes mellitus
- alcohol ingestion

Most postoperative AF is self-limited, although it tends to be recurrent. AF that persists for greater than 48 hours is associated with an increased risk of stroke and transient ischemic attack (TIA). Thus, after 48 hours of AF, anticoagulation should be considered, weighing the potential benefits against the risk of postoperative bleeding. The risk of stroke due to chronic AF varies greatly depending upon age and coexisting disease (4). Risk factors for stroke include previous stroke or TIA, history of hypertension, congestive heart failure, advanced age, diabetes mellitus, coronary artery disease and thyrotoxicosis. A scoring system, (CHADS₂), has been devised to assess this risk and to direct anticoagulation therapy. Patients with total scores of 2 or higher should be anticoagulated with warfarin (5,6).

<u>Risk Factor</u>	<u>Points</u>
Congestive heart failure	1
Hypertension	1
Age ≥ 75 years	1
Diabetes mellitus	1
Prior stroke or TIA	2

The risk of stroke in patients with non-rheumatic, chronic AF is five-fold higher than in patients in sinus rhythm, corresponding to a 4% to 5% annual incidence of stroke. The proportion of stroke resulting from AF increases with age, rising from 6.5% for ages 50-59 years to approximately 31% for ages 80-89 years (3,4). In these high risk groups, long term anticoagulation has been shown to reduce stroke risk by 67% (7).

Treatment of AF is directed at three primary objectives: 1) controlling the ventricular response, 2) preventing thromboembolism, and 3) maintaining sinus rhythm. Efforts to hasten conversion of AF with anti-arrhythmic agents have largely been unsuccessful due to poor efficacy and undesired side effects. Thus, ventricular rate control remains a principal goal of therapy for patients in the ICU (8). In patients with persistent AF greater than 15 minutes, initiation of therapy to control the ventricular rate is recommended. Intravenous beta-blockers are a logical choice in postoperative patients with high sympathetic tone. Use of beta-blockers during the perioperative period has been suggested to reduce mortality and cardiovascular complications up to two years after surgery (9). Amiodarone should be used in patients with decreased left-ventricular dysfunction (ejection fraction < 0.40). Calcium-channel blockers may be used in COPD patients who should not receive beta-blockade. Digoxin is less effective in achieving acute rate control because of a delay in onset of action and a lack of efficacy in hyperadrenergic postoperative states. The use of beta-blockers, calcium-channel blockers, and digoxin should be avoided in patients with pre-excitation syndromes as it can lead to the development of heart block (10). Thus, there is no single agent that has emerged as the drug of choice for converting AF to sinus rhythm (1,11).

The American College of Chest Physicians recommends that all patients with AF of more than 48 hours duration receive therapeutic anticoagulation for 3 weeks before and 4 weeks after cardioversion—electric or pharmacologic—unless emergency cardioversion is indicated. An alternative is to screen patients for intra-atrial thrombus using transesophagealechocardiography (TEE). If no clot is seen, the patient may be cardioverted immediately with heparinization, but should still receive at least 4 weeks of therapeutic anticoagulation after conversion. No anticoagulation is required when patients have AF for less than 48 hours (3,12).

LITERATURE REVIEW

Brathwaite and colleagues prospectively observed 462 consecutive noncardiac, nonthoracic surgery patients in the ICU for atrial arrhythmias. New arrhythmias occurred in 10.2% of patients. Most began within the first two postoperative days. These patients had a significantly higher mortality rate (23.4% vs. 4.3%), longer ICU stay (8.5 ± 17.4 vs. 2.0 ± 4.5 days), and longer hospital stay (23.3 ± 23.6 vs. 13.3 ± 17.7 days) than patients without atrial arrhythmias (p<0.02). Although not the cause of death, atrial arrhythmias appear to be markers of increased morbidity and mortality (2).

Balser et al randomized 63 noncardiac surgical ICU patients with recent-onset SVT to receive intravenous diltiazem or intravenous esmolol. Patients who received esmolol experienced a 59% rate of conversion to sinus rhythm within 2 hours of treatment compared with only 33% for patients randomized to receive diltiazem (intention to treat, $p=0.049$). After 12 hours of therapy, the number of patients converting to sinus rhythm increased in both groups (esmolol 85%; diltiazem, 62%), and the rates of conversion were no longer significantly different. The in-hospital mortality rate and ICU length of stay were not statistically different between the two treatment groups (8).

Mooss and colleagues randomized 30 patients with AF after coronary bypass and/or valve replacement surgery to receive either esmolol or diltiazem. During the first 6 hours of treatment, 67% of esmolol-treated patients converted to sinus rhythm compared to 13% of the diltiazem-treated patients ($p < 0.05$). At 24 hours, 80% of esmolol-treated patients had converted to sinus rhythm compared to 67% of the diltiazem group (not significant) (13).

Vardas et al investigated the efficacy and safety of amiodarone administration as the drug of choice in the conversion of AF in a prospective, randomized, controlled clinical trial. One-hundred eight patients received amiodarone (300mg IV for 1 hour, then 20 mg/kg IV for 24 hours, then 200 mg TID orally for 1 week, then 400 mg/day for 3 weeks) and 100 patients received placebo treatment. All patients were loaded with 1 mg of digoxin initially followed by a daily dose. Conversion to sinus rhythm was achieved in 81% of patients in the amiodarone group, and in 40% of patients in the placebo group ($p < 0.0001$) (14).

Joseph and colleagues conducted a prospective, randomized, controlled, multi-center trial comparing the efficacy and safety of sotalol and amiodarone in conversion of new-onset AF to sinus rhythm at 48 hours compared with rate control alone with digoxin. One hundred and twenty patients who presented to the emergency room with AF less than 24 hours were randomized to receive sotalol, amiodarone, or digoxin using a single intravenous dose followed by 48 hours of oral treatment. There was a significant reduction in the time to conversion with both sotalol (13.0 ± 2.5 hours, $p < 0.01$) and amiodarone (18.1 ± 2.9 hours, $p < 0.05$) group compared with digoxin (26.9 ± 3.4 hours). At 48 hours, the sotalol and amiodarone groups were significantly more likely to convert AF to sinus rhythm than the digoxin group. There were also more adverse events associated with digoxin use, including left ventricular failure (15).

Karth and colleagues conducted a prospective, randomized, controlled study to compare the rate-lowering effect of diltiazem and two amiodarone regimens in critically ill patients with recent-onset atrial tachyarrhythmias. In patients achieving tachycardia control, diltiazem showed a significantly better rate reduction over time ($p=0.001$) when compared to the amiodarone groups. However, the primary study end point ($>30\%$ rate reduction within 4 hours), was met by all groups without any significant differences. Premature drug discontinuation due to hypotension was required significantly more often with diltiazem. The study concluded that rate control can be achieved in critically ill patients with atrial tachyarrhythmias using either diltiazem or amiodarone. Although diltiazem allowed for significantly better 24 hour heart rate control, this effect was offset by a significantly higher incidence of hypotension requiring discontinuation of the drug. Amiodarone may be an alternative in patients with severe hemodynamic compromise (16).

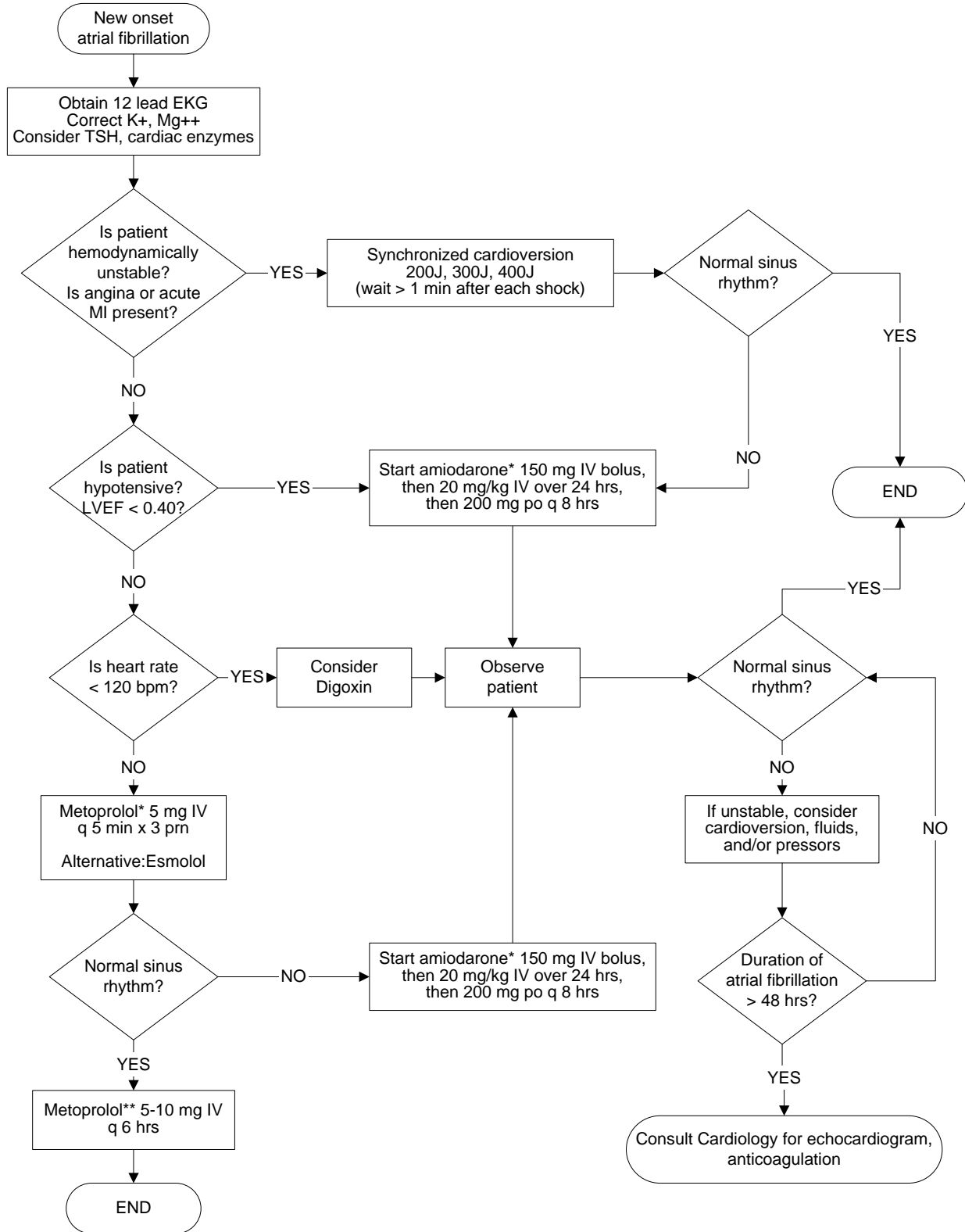
There is a growing body of recent literature comparing rhythm versus rate control strategies for treatment of AF. Wyse and colleagues have published the largest study to date following 4060 patients for a mean of 3.5 years. At 5 years, 60% of the rhythm control group and 35% of the rate control group were in sinus rhythm. There was no difference in mortality between the groups; however, the rhythm control group had significantly more hospitalizations and adverse drug effects. Furthermore, the rhythm control group was much more likely to be either subtherapeutic or off of anticoagulation, placing them at greater risk for a CVA (17).

Van Gelder and colleagues randomized 522 patients to rhythm and rate control arms and followed them for a mean of 2.3 years. The rhythm control cohort showed sinus rhythm in 39% of the group while the rate control cohort had a sinus rhythm in 10% of the group. These two groups also showed no significant difference in outcomes (18). In general, the rhythm control groups in these studies showed better exercise tolerance. This is balanced against increased hospitalizations, risk of adverse drug effects, and a trend towards increased thromboembolic events (7,19).

REFERENCES

1. Hollenberg SM, Dellinger RP. Noncardiac surgery: postoperative arrhythmias. *Critical Care Medicine* 2000; 28:No. 10 (Suppl.) pp 145-150.
2. Brathwaite D. The new onset of atrial arrhythmias following major noncardiothoracic surgery is associated with increased mortality. *Chest* 1998; 114:462-468.
3. Jahangir A et al. Atrial Fibrillation. *In: Podrid PJ, Kowey PR. Cardiac Arrhythmia. Second Edition. Lippincott Williams & Wilkins, 2001, pp 457-488.*
4. Masoudi FA, Goldschlager N. Advances in supraventricular tachycardia. *Cardiology Clinics* 1997; 4:1-48.
5. Medi C, Hankey GJ, Freedman SB. Atrial fibrillation. *Med J Aust* 2007; 186(4):197-202.
6. Fuster V, et al. ACC/AHA/ESC 2006 Guidelines for the Management of Patients with Atrial Fibrillation: 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 (Writing Committee to Revise the 2001 Guidelines for the Management of Patients With Atrial Fibrillation): developed in collaboration with the European Heart Rhythm Association and the Heart Rhythm Society. *Circulation* 2006; 114(7):257-354.
7. Sherman DG. Stroke prevention in atrial fibrillation: pharmacological rate versus rhythm control. *Stroke* 2007; 38(2 Suppl) 615-617.
8. Balser JR et al. β -Adrenergic blockade accelerates conversion of postoperative supraventricular tachyarrhythmias. *Anesthesiology* 1998; 89:1052-1059.
9. Mangano DT. Effect of atenolol on mortality and cardiovascular morbidity after noncardiac surgery. *N Engl J Med* 1996; 335:1713-1720.
10. Mann CJ, Kendall S, Lip GY. Acute management of atrial fibrillation with acute haemodynamic instability and in the postoperative setting. *Heart* 2007; 93(1):45-47.
11. Fuster V et al. ACC/AHA/ESC guidelines for the management of patient with atrial fibrillation. *Eur Heart J* 2001; 20:1852-1923.
12. Pelosi F, Morady F. Evaluation and management of atrial fibrillation. *Med Clin North Am* 2001; 85:225-243.
13. Mooss AN et al. Esmolol versus diltiazem in the treatment of postoperative atrial fibrillation/atrial flutter after open heart surgery. *Am Heart J* 2000; 140:176-180.
14. Vardas PE et al. Amiodarone as a first-choice drug for restoring sinus rhythm in patients with atrial fibrillation. *Chest* 2000; 117:1538-1545.
15. Joseph AP, Ward MR: A prospective, randomized controlled trial comparing the efficacy and safety of sotalol, amiodarone, and digoxin for the reversion of new-onset atrial fibrillation. *Annals of Emergency Medicine* 2000; 36:1-9.
16. Karth GD et al. Amiodarone versus diltiazem for rate control in critically ill patients with atrial tachyarrhythmias. *Crit Care Med* 2001;29:114
17. Wyse DG, et al. A comparison of rate control and rhythm control in patients with atrial fibrillation. *N Engl J Med* 2002;347(23):1825-1833.
18. Van Gelder IC, et al. A comparison of rate control and rhythm control in patients with recurrent persistent atrial fibrillation. *N Engl J Med* 2002;347(23):1834-1840.
19. Lim HS, Hamaad A, Lip GY. Clinical review: clinical management of atrial fibrillation - rate control versus rhythm control. *Crit Care* 2004; 8(4):271-279.
20. Vassallo P, Trohman RG. Prescribing amiodarone: an evidence-based review of clinical indications. *JAMA* 2007; 298(11):1312-1322.

ATRIAL FIBRILLATION TREATMENT IN THE SURGICAL PATIENT



- * Haloperidol and Moxifloxacin used concomitantly with Amiodarone may prolong QTc.
- * Digoxin dosing should be reduced 50% and monitor levels.
- * Warfarin dosing should be reduced 25% and monitor levels.
- ** For patients with COPD or cocaine abuse, consider Diltiazem rather than Metoprolol or Esmolol