Chapter 9
Atrial Fibrillation

Kay M. Johnson and Paul B. Cornia

BACKGROUND

Atrial fibrillation is commonly encountered by the medical consultant, in patients with preexisting atrial fibrillation as well as those with a new onset in the postoperative period. Balancing the risk of stroke versus the risk of bleeding complications is required for the perioperative management of anticoagulation. Strategies for maintaining rate and/or rhythm control must be considered.

PREOPERATIVE EVALUATION

FOR PATIENTS WITH PREEXISTING ATRIAL FIBRILLATION

- Determine whether the atrial fibrillation is paroxysmal versus persistent.
- Review medication list with the patient, noting rate-controlling agents, antiarrhythmics, anticoagulants, or antiplatelet agents.
- Identify any history of rheumatic valvular heart disease, heart failure, hypertension, transient ischemic attack (TIA), or stroke.
- Review prior echocardiogram(s).
- Review previous management of interruptions in anticoagulant therapy, including prior use of bridge heparin therapy (see below).
- Perform a complete cardiovascular examination (heart rate, cardiac murmurs, signs of heart failure) and an electrocardiogram (ECG).
- Estimate the risk for arterial thromboembolism (e.g., using $CHADS_2$ scoring system, see below) [1].

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- Per American College of Cardiology/American Heart Association (ACC/AHA) guidelines, a supraventricular arrhythmia with a heart rate >100 beats per minute at rest is considered an "active cardiac condition" that should be addressed prior to surgery (see Chap. 6).

PERIOPERATIVE MANAGEMENT

PREOPERATIVE MANAGEMENT

Key issues for the medicine consultant include optimal perioperative rate and rhythm control, and management of anticoagulation, which may include antiplatelet agents, warfarin, or newer oral anticoagulants.

Rhythm and Rate Control

AV nodal blockers are typically continued perioperatively, and a post-op plan should be made for continuing these agents, taking into account whether the patient is anticipated to be able to take oral medications (See Table 9.1). For patients receiving less commonly used medications such as sotalol, propafenone, and amiodarone, consider discussing management with the patient's cardiologist.

Management of Antiplatelet Agents

Decisions about antiplatelet agents preoperatively should take into account potential risks and benefits of aspirin cessation; management is increasingly deferred to the individual practices of the surgical team. When it is necessary to discontinue aspirin, aspirin/dipyridamole, or clopidogrel for surgery, they are generally held for 7 days prior to surgery. Consider holding antiplatelet agents longer (up to 14 days) for specific cases, including neuro/spine surgery. When the patient also has significant cardiovascular disease, especially recently implanted coronary stents, consider discussing antiplatelet management with the patient's cardiologist (see Chap. 7).

Warfarin Anticoagulation and Heparin Bridge Therapy

For most surgical procedures, warfarin must be interrupted perioperatively (see below for exceptions), leaving the patient without anticoagulation for several days. A decision must be made about whether "bridging" with heparin is warranted to minimize the duration of the interruption in anticoagulation. A multidisciplinary approach to this decision is recommended, involving the patient, perioperative medicine consultant, surgeon, and anesthesiologist, as well as the

TABLE 9.1 POSTOPERATIVE MANAGEMENT OF PATIENTS WITH PREEXISTING ATRIAL FIBRILLATION

Rate control	If NPO Individualize desired rate control target, depending on the patient's baseline rate control goals, the presence of ischemic heart disease, and the patient's post-op blood pressure. In most cases, a heart rate of 70–100 is reasonable Metoprolol IV (start 5 mg IV q 6 h and individualize dosing) OR Diltiazem IV infusion Continue digoxin (IV) if receiving digoxin pre-op Transition to PO meds when tolerating a diet For patients taking a diet In most cases, resume patient's usual outpatient rate control regimen. Watch for hypotension since some patients are relatively volume depleted and the blood pressure-lowering effect of some rate control medications may be less well tolerated initially post-op
Anticoagulation	Resume anticoagulation when surgically acceptable (see Chap. 18) Bridge with heparin, if indicated, until therapeutic on warfarin If anticoagulation is not started immediately due to bleeding risk, venous thromboembolism prophylaxis should still be given, unless there is a contraindication

clinicians managing the patient's anticoagulation in the outpatient setting (e.g., primary care provider, anticoagulation clinic). Develop a plan for perioperative anticoagulation prior to surgery whenever possible. Discuss the plan with the patient, provide written instructions, and clearly document the plan in the medical record. The plan should anticipate postoperative conditions affecting resumption of anticoagulation. Chapter 18 details our approach to bridging anticoagulation, which is based on the 2012 American College of Chest Physicians (ACCP) Guidelines [2].

Note that warfarin need not be stopped for certain low-risk procedures, e.g., dental extractions, dermatologic procedures, and cataract surgery. Ensure that the surgeon is in agreement with this plan and

that the pre-op INR is <3.0. Some issues specific to bridging for atrial fibrillation are presented here:

2012 ACCP Practice Guidelines

- These guidelines offer recommendations for perioperative anticoagulation management based on observational data and clinical experience [2].
- The guidelines use the $CHADS_2$ scoring system to estimate stroke risk (see footnote to Table 9.3 in this chapter for details on how the $CHADS_2$ is calculated).
- For patients at low risk of stroke ($CHADS_2$ score = 0–2, assuming no prior stroke/TIA), bridge heparin is not recommended.
- For patients at high risk for perioperative thromboembolism (defined as $CHADS_2$ score =5–6, stroke/TIA within the past 3 months or associated rheumatic valvular heart disease), bridge heparin is recommended.
- For patients at moderate risk ($CHADS_2$ score = 3–4), the limited data do not allow a specific approach to be recommended for all patients; patient and surgery-specific factors should be assessed on a case-by-case basis. This is a change from prior ACCP guidelines which suggested bridging for $CHADS_2$ score 3–4. As an example of surgery-specific factors to take into account, the current guidelines recommend providers consider not bridging these moderate-risk patients if undergoing high bleeding risk procedures, including major cardiac surgery or carotid endarterectomy.

CHA_2DS_2-VASc Score

- A newer stroke risk prediction tool, the CHA_2DS_2-VASc score, adds female gender, age 65–74, and history of vascular disease to the scoring [3].
- Whether it is more predictive of stroke risk than $CHADS_2$ is being investigated.
- It may be helpful in further defining the risk of stroke in patients with a $CHADS_2$ score 0–1, a group that is already at low-enough risk not to warrant bridging.

Bridging Strategies

- In most cases, warfarin is held for 5 days (five doses) prior to surgery.
- Individualize the number of days that anticoagulation will be held pre-op based on the type of surgery (e.g., neurosurgery, spine surgery, and highly vascular tumors may require a longer period off of anticoagulation), the surgeon's preference, and

the baseline dose of warfarin (patients requiring lower doses tend to have INRs that normalize more slowly).
- Do not assume that outpatient procedures are low risk for post-procedure surgical bleeding (e.g., angioembolization). Discuss with the surgeon or interventionalist.
- For details on how to manage bridging and the pros and cons of LMW heparin versus IV unfractionated heparin, see Chap. 18.

Management of Recently Approved Anticoagulants

Dabigatran is an alternative to warfarin for the prevention of stroke in patients with atrial fibrillation. It is an oral direct competitive inhibitor of factor IIa (thrombin) that does not require coagulation monitoring nor bridging with heparin when interrupted [4]. Its clearance is affected by renal function, and though it is not metabolized by the cytochrome P450 (CYP3A4) system, dabigatran still has many drug interactions (including dronedarone, ketoconazole, amiodarone, verapamil, quinidine, and rifampin) [5, 6]. Contraindications include a prosthetic heart valve or hemodynamically significant valve disease, severe renal failure (CrCl <15 mL/min), or advanced liver disease (impaired baseline clotting function) [5]. It is generally not recommended for CrCl less than 30.

Dabigatran should be held 1–4 days prior to surgery, depending on the risk of perioperative bleeding and the patient's renal function. For surgeries with a "standard" risk of bleeding, recommendations are to hold for at least 24 h for CrCl > 50 mL/min and at least 48 h for CrCl 30–50 mL/min. For surgeries with a high risk of bleeding or in which complete hemostasis is required (including abdominal, cardiac, neurosurgery, any major organ surgery, and the use of spinal anesthesia), hold dabigatran for 2–4 days in patients with CrCl > 50 mL/min and 4 days for CrCl 30–50 mL/min [4, 6] (see also Chap. 18).

Unlike warfarin, the anticoagulant effect of dabigatran begins within 2–3 h of the first dose when it is resumed [4]. No antidote to dabigatran is available in the event of bleeding. Its clearance is somewhat hastened by dialysis, but the use of dialysis to help manage a bleeding complication would only be recommended in patients who are already receiving dialysis.

Rivaroxaban and apixaban are oral direct factor Xa inhibitors approved for stroke prevention in nonvalvular atrial fibrillation [7, 8]. Dosing is adjusted for renal function. Like dabigatran, they do not require monitoring or bridging with heparin. There are no reversal agents for these medications and they cannot be dialyzed [5]. Each is held 24 h prior to procedures with standard risk of bleeding or 24–48 h before procedures with high risk of bleeding [6].

POSTOPERATIVE MANAGEMENT

Recommendations for the postoperative management of patients with preexisting atrial fibrillation are summarized in Table 9.1. Review the initial plan for resumption of anticoagulation. Adjustments may be necessary, depending on the surgeon's assessment of the patient's bleeding risk or if unanticipated complications arise. If therapeutic anticoagulation is not restarted immediately postoperatively, patients should still receive venous thromboembolism chemoprophylaxis unless there is an absolute contraindication. Patients should be monitored for embolic complications.

Prevention of Postoperative Atrial Fibrillation

In cardiac surgery, postoperative atrial fibrillation is common. According to the 2014 ACC/AHA/Heart Rhythm Society (HRS) guidelines for the management of atrial fibrillation [9], preoperative administration of amiodarone reduces the incidence of atrial fibrillation in patients undergoing cardiac surgery and is reasonable for prophylactic therapy in patients at high risk for atrial fibrillation. Prophylactic sotalol or colchicine may also be considered for patients undergoing cardiac surgery, and statins may be beneficial in patients undergoing coronary revascularization [9]. Use of medications for atrial fibrillation prevention is usually deferred to the cardiac surgeon.

In noncardiac surgery, three small randomized trials have studied prophylactic amiodarone use in thoracic surgery patients (lung resection surgery, lung cancer surgery, and esophagectomy). All three studies showed a reduction in post-op atrial fibrillation [10]. Current practice guidelines do not offer specific recommendations on the use of amiodarone for this indication.

Management of New-Onset Postoperative Atrial Fibrillation

- Identify precipitating causes (e.g., heart failure, electrolyte imbalance, infection, infarction, alcohol withdrawal, thyroid abnormalities, anemia, hypovolemia, lung disease, valvular heart disease, pulmonary embolism, volume overload/reabsorbed third-spaced fluids, etc.).
- Assess how well the patient is tolerating the arrhythmia: symptoms, hypotension, and evidence of heart failure or ischemia.
- Obtain an echocardiogram to assess left ventricular EF and look for valvular heart disease.
- Rate control for atrial fibrillation with rapid ventricular response: Generally start with IV agents if rate control is needed urgently. Use caution when considering beta-blockers and

TABLE 9.2 RATE CONTROL STRATEGIES FOR NEW-ONSET POST-OP ATRIAL FIBRILLATION WITH RAPID VENTRICULAR RESPONSE

Metoprolol	5 mg IV × 1. May repeat ×2 if additional rate control needed and BP remains stable
Diltiazem	Bolus 10–20 mg IV, then start IV infusion at 10–20 mg/h, titrate to HR 80–100
Digoxin	Acts more slowly. 0.5 mg IV × 1, then 0.25 mg IV Q6H ×2 Give daily and titrate to effect; typical dose is 0.125 mg IV or PO daily Reduce dose if renal dysfunction. Use caution in elderly patients
Amiodarone	150 mg IV bolus, then load with 1 mg/min IV × 6 h, then 0.5 mg/min × 18 h Indicated for refractory atrial fibrillation or atrial fibrillation with heart failure Check baseline TSH, PFTs
Esmolol	50–300 mcg/kg/min IV. Can bolus 500 mcg/kg IV initially Watch for hypotension
PO medications	Multiple options: metoprolol, atenolol, or diltiazem Digoxin or amiodarone, if indicated
Cardioversion	Immediate cardioversion is indicated if hemodynamically unstable. Must address anticoagulation

calcium channel blockers in patients with heart failure or hypotension (see Table 9.2).

Post-op atrial fibrillation often resolves spontaneously, or there may be brief, self-limited episodes of atrial fibrillation that resolve once the postoperative stress resolves; anticoagulation is generally not necessary for these patients. When atrial fibrillation persists or continues to recur, antithrombotic therapy (i.e., antiplatelet or anticoagulant) should be considered for patients at increased risk of stroke:

- The $CHADS_2$ score (Table 9.3) is commonly used as a risk stratification tools used in practice [1, 11].
- This decision should be made on an individual basis, taking into consideration the patient's risk factors and personal goals as much as possible. Consultation with the patient's primary care provider may be helpful.
- For high-risk patients with atrial fibrillation deemed unsuitable for anticoagulation, dual antiplatelet therapy with clopidogrel

TABLE 9.3 $CHADS_2$ RISK STRATIFICATION FOR ATRIAL FIBRILLATION

Score	Annual stroke risk	Recommended anticoagulation
0	1.9	ASA
1	2.8	ASA or warfarin
2	4.0	Warfarin
3	5.9	Warfarin
4+	>7 %	Warfarin

Scoring: 1 point for CHF, HTN, Age > 75, DM; 2 points for a history of TIA/CVA. However, if the $CHADS_2$ score is 2 because of a history of TIA/CVA, the annual stroke risk is likely *greater* than 4 %

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and aspirin can be considered; this offers more protection against stroke than aspirin alone but with an increased risk of major bleeding [11].

When rhythm control is considered, it is advisable to obtain cardiology consultation to advise on issues around pharmacologic and electrical cardioversion and potential need for transesophageal echocardiogram to decrease the risk of cardioembolic stroke. Key points for the medicine consultant include:

- Amiodarone is often used but has a very long half-life and may cause significant long-term side effects.
- Dronedarone is a newer agent with potentially less pulmonary and thyroid side effects compared with amiodarone. However, it is only available orally and should be avoided in patients with heart failure and may increase cardiovascular events in high-risk patients with permanent atrial fibrillation; it is not advised in new-onset post-op atrial fibrillation pending resolution of these safety concerns.
- Other antiarrhythmic agents (such as dofetilide, flecainide, propafenone, and sotalol) and cardioversion may be considered in consultation with a cardiologist.

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