INVESTIGATION AND NON-DRUG MANAGEMENT OF ATRIAL FIBRILLATION

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When a new patient apparently has atrial fibrillation

Is it atrial fibrillation?

Why did the patient develop it? (What is the underlying cause?)

Why does the patient have it now? (Are any precipitating factors present?)

Certain points should be considered when deciding how to manage patients with atrial fibrillation. Firstly, is the diagnosis of atrial fibrillation certain? It is also important to distinguish between chronic and paroxysmal atrial fibrillation as the two conditions have to be managed differently. Secondly, the underlying aetiological or predisposing factor should be sought. Finally, in acute presentations of atrial fibrillation the presence of any acute precipitating factors—for example, infection—should be considered.

Investigations

Diagnosing and assessing atrial fibrillation

Recording of patient's history and clinical features—for example, paroxysmal atrial fibrillation

Documentation of the arrhythmia—for example, with a 24 hour Holter monitor

Echocardiography, especially in young patients

Exercise testing if ischaemic heart disease is present (caution needed in interpreting result if patient is taking digoxin)

The investigation of a patient with atrial fibrillation requires taking a careful clinical history (including medical history), with emphasis on certain clinical features—for example, whether the symptoms are sustained or intermittent and whether any complications, such as heart failure, stroke, or thromboembolism, are present. At the first consultation basic blood tests should be done, including full blood count and tests of renal function, electrolytes, and thyroid function.

Demonstration of 24 hour Holter monitor.

Electrocardiography

The arrhythmia should then be documented, firstly with a conventional 12 lead electrocardiogram. This may provide a clue to the aetiology or electrophysiological features that may cause arrhythmia—for example, ischaemic heart disease (previous myocardial infarction), left ventricular hypertrophy, or a pre-excitation syndrome (δ wave in the Wolff-Parkinson-White syndrome if in sinus rhythm).

Cardiomemo machine for monitoring patients with intermittent symptoms.

A 24 hour Holter monitor may be needed to document paroxysmal atrial fibrillation or the sick sinus syndrome. This investigation is unlikely to be rewarding, however, in patients who have only intermittent and infrequent symptoms such as palpitations. In such patients, a "cardiomemo" (or "transtelephonic event monitor") may be preferred. This device allows an electrocardiographic trace to be transmitted via a telephone; the patient may thus "record" an electrocardiogram during an episode of palpitations. Cardiomemos are fairly cheap, simple to use, and may even be used by general practitioners.

Chest radiograph of patient with atrial septal defect showing cardiomegaly, prominent hila, and pulmonary plethora.

Chest radiograph of patient with mitral stenosis showing straight left heart border, with prominent left atrial appendage and dilated left atrium resulting in a "double contour" next to the right heart border.

Chest radiography

A chest x ray examination is useful in most patients with atrial fibrillation. In a young patient it may provide a clue to congenital heart disease, such as atrial septal defect. In an older patient a chest x ray film can give information on the size of the heart and whether the patient has heart failure.

Echocardiographic and clinical predictors of stroke in atrial fibrillation

- Independent transthoracic echocardiographic predictors of stroke in patients with atrial fibrillation include left ventricular dysfunction and dilated left atrium:

Echocardiographic finding	Relative risk
Global left ventricular dysfunction	2.6
Dilated left atrium on M mode:	
2.4 cm/m ² (left atrium=4.7)	1.6
2.9 cm/m ² (left atrium=5.7)	2.7

- Clinical risk factors include a history of hypertension, recent (within three months) congestive heart failure, and previous cerebrovascular event (stroke or transient ischaemic attack)
- Percentage risk stratification (per year) for stroke and thromboembolism on the basis of clinical and echocardiographic predictors:
 - 1.0 (for patients with no risk factors)
 - 6.0 (one risk factor)
 - 18.6 (two or three risk factors)

Echocardiography

Most cardiologists request an echocardiogram for patients with atrial fibrillation. In most patients echocardiography helps cardiologists to diagnose structural heart disease (including valvar heart disease) and to document left ventricular function.

Echocardiography may also help to establish the likelihood of successful cardioversion to sinus rhythm—for example, poor left ventricular function is an unfavourable sign. Recently, transoesophageal echocardiography has provided a means of identifying left atrial appendage thrombi, especially if a mitral prosthetic valve is in situ.

Demonstration of echocardiography.

Two dimensional echocardiogram showing left ventricular hypertrophy.

Echocardiogram showing atrial septal defect. Arrow shows colour Doppler signal of blood flow through defect.

Role of echocardiography

- To refine the thromboembolic risk stratification in patients unsuitable for cardioversion (echocardiography may also help to determine which patients need warfarin or aspirin)
- To identify patients who might be suitable for cardioversion to sinus rhythm
- To help to classify patients with "lone" atrial fibrillation
- To help to diagnose patients with congenital heart disease, such as an atrial septal defect
- To help to exclude intracardiac thrombus, especially in patients with atrial fibrillation and stroke or thromboembolism, and, possibly, before cardioversion (transoesophageal echocardiography is particularly useful for these purposes)

In practice, however, atrial fibrillation is so common in the general population that the resources available for routine echocardiography would be grossly insufficient; the public health issues surrounding the management of atrial fibrillation have so far been largely ignored.

Atrial fibrillation—standard investigations

Blood tests

- Full blood count—especially when anticoagulants are being considered
- Urea and electrolytes—to establish baseline and if considering drug treatment (for example, reduced dose of digoxin in renal impairment)
- Thyroid function tests

Electrocardiography, including ambulatory electrocardiography

- 12 Lead electrocardiogram
- Possible use of 24 hour Holter monitor—if patient presents with syncope, and paroxysmal atrial fibrillation or the sick sinus syndrome is suspected
- Possibly use of cardiomemo—if symptoms are only intermittent and infrequent

Chest radiography

Echocardiography

- Standard transthoracic echocardiography and Doppler ultrasound examination
- Possibly transoesophageal echocardiography if a prosthetic mitral valve is in situ or if endocarditis or atrial thrombi are suspected

Exercise testing

Exercise testing is necessary in some patients with ischaemic heart disease and atrial fibrillation to clarify the severity of underlying cardiac ischaemia. Exercise electrocardiograms must be interpreted cautiously, however, if treatment with digoxin is given. Such testing may also have a role in assessing the adequacy of drug treatment in controlling the ventricular response in atrial fibrillation.

Electrophysiology studies

In patients with atrial fibrillation due to a pre-excitation syndrome, referral to a specialist for electrophysiology studies may be needed to document the characteristics of conduction from the atria to the ventricles and the presence of accessory pathways. This may also lead to a “cure” of the condition by transcatheter ablation of the accessory pathway.

Non-drug management

Non-drug treatment

Avoidance of precipitating factors—for example, alcohol

Pacemaker for the sick sinus syndrome

Ablation of an accessory pathway—for example, the Wolf-Parkinson-White syndrome

Ablation of the atrioventricular node and insertion of a permanent pacemaker

Surgery—for example, the “maze” and “corridor” procedures

General measures

General measures—such as asking the patient to reduce his or her caffeine or alcohol intake in cases of paroxysmal atrial fibrillation—should always be considered. Conditions that may benefit from atrial pacing—for example, the sick sinus syndrome—should also be considered. In patients with acute conditions—for example, those who develop atrial fibrillation postoperatively—hypoxia and abnormalities in the electrolytes should be excluded.

It is also important to distinguish between atrial fibrillation and atrial flutter as important differences exist in the management of these two conditions.

Ablation and implantation of pacemaker

In patients with atrial fibrillation and rapid ventricular beats that are poorly controlled by drugs, atrioventricular node and His bundle ablation, and implantation of a permanent pacemaker may be considered. If paroxysmal atrial fibrillation is present as part of the sick sinus syndrome then a permanent pacemaker should be considered. Either an atrial or a dual chamber pacemaker should be used, depending on the integrity of the atrioventricular pathway.

Electrical ablation of the atrioventricular bundle with a transvenous catheter and insertion of a permanent pacemaker was first described by Scheinman and colleagues in 1982. Ablation for arrhythmias is a specialist procedure in which the atrioventricular node is destroyed without surgery, usually by using a high energy radiofrequency current via electrodes on a catheter. Concomitant implantation of a permanent pacemaker is required, however, as ablation of the atrioventricular node results in complete heart block.

The technique results in control of the ventricular rate but sacrifices the physiological pacemaker function of the sinoatrial node. In addition, atrial transport is lost, and, as the risk of thromboembolism remains, anticoagulant treatment is still needed. Electrical ablation is also used in patients with a pre-excitation syndrome secondary to an accessory pathway, in which ablation of the anomalous conducting tissue is performed.

Chest radiograph showing position of dual chamber pacemaker.

X-ray film (and diagram) showing radiofrequency ablation of accessory pathway with electrodes (30° right anterior oblique projection).

Top: "Corridor" procedure. Bottom: "Maze" procedure. Both procedures have been advocated in patients with atrial fibrillation refractory to medical treatment.

Surgery

Surgery for atrial fibrillation has been advocated for treatment of atrial fibrillation refractory to medical treatment, but, although effective, it is unlikely (at least in Britain) to be adopted generally except for specific patients.

The two most promising surgical options are the "corridor" and "maze" procedures. The corridor procedure effectively isolates both the left and the right atrium, leaving a strip of myocardium connecting the sinus node to the atrioventricular node. This procedure does not prevent atrial fibrillation but isolates the fibrillating atria. Although a 70% "cure" rate is reported, sequential atrioventricular contraction is not restored (with the consequent haemodynamic effects), and the risk of thromboembolism remains.

The maze procedure is intended to prevent atrial fibrillation completely by channelling the atrial activation between a series of incisions. This procedure therefore restores coordinated atrial as well as ventricular electrical activity, permitting atrial transport with good haemodynamic results and low thromboembolic risk.

Initial reports from both these procedures are encouraging, but postoperative implantation of a pacemaker may still be necessary.

Histograms showing atrial fibrillation in patients randomised to atrial and ventricular pacing in sick sinus syndrome. Chronic atrial fibrillation was defined as atrial fibrillation at two consecutive visits.

Management of sick sinus syndrome

In the presence of symptomatic bradyarrhythmias, permanent pacing is indicated. Evidence exists that simple ventricular pacing systems may result in an increase in the incidence of permanent and paroxysmal atrial fibrillation, hypotension (with a fall of cardiac output of up to one third), thromboembolic events (stroke or peripheral artery embolus), congestive heart failure, and worsened prognosis. In contrast, regular atrial pacing, either alone or combined with ventricular pacing, is often effective in preventing paroxysmal atrial fibrillation associated with the "tachy-brady syndrome" (alternating tachycardia and bradycardia), perhaps by stabilising the atrium electrically, and can therefore improve the overall prognosis. In addition, atrial pacing preserves the normal sequence of cardiac chamber activation.

Patients with the sick sinus syndrome also seem to be at increased thromboembolic risk, and this is thought to be associated with the tachy-brady syndrome. Such patients therefore also need formal anticoagulation.

Key references

- Brugada P, Gürsoy S, Brugada J, Andries E. Investigation of palpitations. *Lancet* 1993;**341**:1254-8
- Wagshal AB, Pires LA, Huang SKS. Management of cardiac arrhythmias with radiofrequency catheter ablation. *Arch Intern Med* 1995;**155**:137-47
- McComb JM. Surgery for atrial fibrillation. *Br Heart J* 1994;**71**:501-3

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