

CHANGES IN LEFT ATRIAL SIZE AND CARDIAC RHYTHM IN PATIENTS AFTER MITRAL VALVE SURGERY

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Abstract

Mitral valve disease often leads to dilatation of the left atrium and subsequent atrial fibrillation. We evaluated changes in sinus rhythm and left atrial size in a group of 77 patients (17 men, 60 women; average age, 60.7 years) who underwent mitral valve surgery (53 valve replacements and 24 valve repairs) between January 2000 and September 2001. The mean left atrial size was 56.2 mm before surgery (A), 52.6 mm on discharge from hospital (B) and 50.9 mm at one-year follow-up (C). The differences between A and B and A and C and that between B and C were statistically significant ($P<0.001$ and $P<0.05$, respectively). The valve replacement or repair also had a favourable effect on the restoration of sinus rhythm; the proportion of patients in sinus rhythm increased from 33% before surgery to 41% at one-year follow-up. In conclusion, surgical treatment of mitral valve disease results in a significant reduction of left atrial size and, in some patients, also in the restoration of sinus rhythm.

Key words

Mitral valve disease, Atrial fibrillation, Left atrial size

INTRODUCTION

Atrial fibrillation is the most common atrial arrhythmia, with a prevalence of 0.5 to 1% in the population (1,2). It arises from non-coordinated depolarisation of the atrial myocardium; the atria are in a seemingly chaotic rapid rhythm produced by multiple interlacing wavelets of re-entrant activity. Transmission of impulses to the ventricles through the atrio-ventricular (A-V) node is irregular and results in an irregular heart rate with a peripheral pulse deficit. The atrium loses its contractile force and the ventricle is deprived of an atrial filling contribution. In the atrium, and especially in its auricle, thrombus formation with a subsequent risk of systemic embolism may occur (3–7).

The most frequent cause of atrial fibrillation is atrial dilatation resulting from volume or pressure overload of the heart, which may occur in ischaemic heart disease, valvular disease, dilated cardiomyopathy, chronic heart failure or, less frequently, due to degenerative, inflammatory or fibrous disease.

The aim of this study was to ascertain whether surgical correction of the mitral valve disease that has caused atrial dilatation with subsequent fibrillation can

reverse this condition and can result in a reduction of left atrial size and the restoration of sinus rhythm.

MATERIALS AND METHODS

Seventy seven patients who underwent a single surgical procedure for mitral valve disease, i.e., mitral valve replacement or repair, in our Centre between January 2000 and September 2001 were included in the study. None of the patients had any other severe valvular disease or concomitant disease leading to left atrium dilatation, nor had any of them severe coronary heart disease. The group comprised 17 men and 60 women; the average age was 60.7 years. Fifty three patients underwent mitral valve replacement and 24 were treated by valve repair, which included commissurotomy in three cases, resection of the posterior leaflet in seven, reconstruction according to Alfieri in nine, reconstruction according to Wooler in one and ring implantation in the mitral annulus in seven cases. The average left ventricular ejection fraction was 52.1%.

The patients with post-operative ventricular frequency higher than 90–100/min received sotalol intravenously to prevent a rapid ventricular response or, when atrial fibrillation was present, to attempt sinus rhythm restoration by medication. The patients with an atrial size less than 50 mm, in whom atrial fibrillation failed to respond to medication, were treated by electrical cardioversion under short-time general anaesthesia.

After surgery all patients were treated with warfarin; in patients with valve replacement this anticoagulation therapy remained permanent and those with valve repair received it for 3 months.

In every patient, cardiac rhythm and left atrial size were evaluated on three occasions: before surgery (A), on post-operative examination (B) and at one-year follow-up (C). Left atrial size was measured by echocardiography in the parasternal long axis. The results were statistically analysed by the paired *t*-test.

RESULTS

The average size of the left atrium before surgery was 56.2 mm, it was reduced to 52.6 mm on discharge and to 50.9 mm after one year. The differences were statistically significant (*Table 1*).

Before surgery, 3% of our patients had pacemakers and 65% had atrial fibrillation. Post-operative examination showed atrial fibrillation also in 65% of the patients. At one-year follow-up this was reduced to 53%, i.e., sinus rhythm restoration was achieved in only 8% of the patients undergoing surgery for mitral valve disease (*Table 2*).

DISCUSSION

Atrial fibrillation is one of the most serious arrhythmias in the population. In the affected patients, quality of life is poorer and mortality from cardiovascular disease is twice that of the average population; in those with no anticoagulation treatment, the risk of embolic stroke increases five-times and, in untreated rheumatic heart disease, up to 17-times.

In our group of patients undergoing surgery for mitral valve disease, 65% had atrial fibrillation before surgery, which is in agreement with the literature data (8). At one-year follow up, the restoration of sinus rhythm was achieved in 8% of our patients; the success rate reported in the literature ranges from 6 to 19% (9,10,11).

Table 1

Average size of the left ventricle

Before operation (A)	56.2 mm		A	
	↓	$P < 0.001$		
On discharge (B)	52.6 mm		↓	$P < 0.001$
	↓	$P < 0.05$		
At one-year follow-up (C)	50.9 mm		C	

Table 2

Pre-operative and post-operative findings

	Sinus rhythm	Atrial fibrillation	Pacemaker
Before operation	33%	65%	3%
On discharge	33%	65%	3%
At one-year follow-up	41%	53%	6%

Anticoagulants in the treatment of patients with atrial fibrillation significantly decrease the risk of embolic stroke. A meta-analysis of pooled results from several studies showed that warfarin, an antithrombotic agent, lowered the incidence of stroke in patients with atrial fibrillation by 65%, as compared to those receiving placebo (12). This implies that even patients on an efficient anticoagulation therapy are still at risk of stroke.

In addition, the anticoagulation therapy itself is associated with several hazards; it increases the frequency and severity of intra- and extracranial haemorrhage and complicates any acute, even minor, surgical intervention. The patient's age and dosage of an anticoagulant are important factors for predicting the risk of serious haemorrhage. With warfarin therapy, this increases exponentially: when INR = 2.0, 0.2% of the treated patients are at risk of haemorrhage; when INR = 3.5, up to 3% of the patients are at risk (13). The optimal dosage of anticoagulation therapy is balancing between two risks: haemorrhage on the one side and embolism on the other. In this situation, removal of the primary cause, i.e., atrial fibrillation, is the best solution. Patients with mitral valve replacement should benefit from a lower risk of embolism and patients with valve repair can be expected to have a lower risk of both embolism (9) and haemorrhage, supposing they do not suffer from atrial fibrillation and do not have to take warfarin.

It is evident that mere repair of valve disease, the most probable cause of fibrillation, is not efficient enough. The restoration of sinus rhythm may be achieved by an additional curative procedure, such as direct surgery for atrial fibrillation, in patients who undergo opening of the left atrium during valvular surgery. Three different approaches are described in the literature: 1) isolation of the fibrillating atrium; 2) fragmentation, i.e., interruption of reentry waves; and 3) creation of canals (the only path for impulse transmission). In procedures with left atrial isolation, applicability has been 90% and persistent restoration of sinus rhythm had a success rate of 80% (14, 15). Surgery involving the use of a corridor, i.e., isolation of a tissue strip with the A-V and sinus nodes, had a success rate of 52% at five-year follow-up (16).

Probably, the most frequently used approach is the Maze procedure developed by Cox *et al.* in the 1980s (17). These authors showed that arrhythmias can be prevented by creating a system of transmural incisions in the both atria, and thus providing a sort of maze that will allow an impulse to travel between the sinus and A-V nodes in only one way. This method has been modified several times and has brought about a significant improvement in outcomes; the long-term restoration of sinus rhythm has been achieved in 80 to 93% of the patients (18,19,20). All these surgical techniques require great skills and are time consuming. Recently, cryoablation or radiofrequency ablation of the pulmonary veins have been used. However, although early and mid-term outcomes are promising, the long-term results are still to be evaluated.

It can be concluded that surgery for mitral valve disease results in a significant reduction of left atrial size but had no great effect on sinus rhythm restoration, because this was achieved in only 8% of the patients treated. It is suggested that better outcomes might be achieved by combining valvular surgery with one of the surgical treatments of atrial fibrillation or intra-operative ablation techniques.

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ZMĚNY VELIKOSTI LEVÉ SÍNĚ A SRDEČNÍHO RYTMU U PACIENTŮ PO OPERACI MITRÁLNÍ CHLOPNĚ

S o u h r n

Onemocnění mitrální chlopně vede velmi často k dilataci levé síně a k následnému vzniku fibrilace síní (FS). U 77 pacientů (průměrný věk 60,7 let, 17 mužů, 60 žen), kteří podstoupili operaci mitrální chlopně (53 náhrad, 24 plastik) na našem pracovišti od 1/00 do 9/01, jsme sledovali změnu srdečního rytmu a velikosti levé síně (LS) – a to před operací, při propuštění a za rok po operaci. Průměrná velikost LS před operací byla 56,2 mm, při propuštění 52,6 mm a při jednoroční kontrole 50,9 mm. Změna velikosti LS před propuštěním i při jednoroční kontrole je oproti předoperačnímu stavu je statisticky významná na 0,1% hladině, změna velikosti LS od propuštění do jednoroční kontroly je statisticky významná na 5% hladině významnosti. Operace mitrální chlopně měla také příznivý vliv na srdeční rytmus – 41% pacientů při jednoroční kontrole mělo sinusový rytmus (SR) oproti 33% před operací. Chirurgický zákrok na mitrální chlopni vede ke statisticky významnému zmenšení LS a v malém procentu případů může vést i k obnovení sinusového rytmu.

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