

# Assessment of Thromboembolism After the Cox-Maze Procedure for Chronic Atrial Fibrillation Secondary to Mitral Valve Lesion

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**Objective** – To assess the occurrence of late thromboembolism after surgical repair of chronic atrial fibrillation (AF) simultaneously with repair of mitral valve using the Cox-Maze procedure.

**Methods** – 69 patients underwent Cox 3 procedure, with no cryoablation simultaneously with mitral valvuloplasty or prosthesis. Mean age was  $49.9 \pm 13.2$  years. Mean follow-up was of  $31.7 \pm 19$  months. Types of lesion were as follows: 33 (48%) stenoses, 23 (33%) insufficiencies, and 13 (19%) double lesions. Procedures were: 64 (93%) valvuloplasties, 3 (4%) biological and 2 (3%) mechanical prosthesis placement. There were 9 (13%) patients with previous systemic embolism and 2 (3%) had left atrial thrombi.

**Results** – Early mortality was 7% and late 1%. 2 patients (3%) were reoperated for mitral placement. At last evaluation, 10 patients (15%), were in AF. The remaining 59 (85%) were either in sinus / atrial rhythm (74%) or under pacing (12%). There were no occurrence of early or late, systemic or pulmonary embolism. Permanent anticoagulation was employed in 16 cases, 10 in regular rhythm and 6 in AF. The remaining 47 (75%), 2 in AF and 45 in regular rhythm, did not receive anticoagulants.

**Conclusions** – These results are in accordance with others series, where the occurrence of embolism was rare after maze procedure. Permanent systemic anticoagulation seems to be unnecessary in those cases.

**Keywords** atrial fibrillation, thromboembolism, mitral valve surgery.

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Atrial fibrillation is the most common arrhythmia. In the general population, its prevalence ranges from 0.15% to 1% and progressively increases with age; between the age of 25 and 35 years, the prevalence of atrial fibrillation may reach 0.2% to 0.3% of the adult population, and between the age of 55 and 64 years, it may reach 3 to 4%. In individuals above the age of 62 years, the prevalence of this arrhythmia may reach 5% to 9%<sup>1</sup>. Atrial fibrillation affects 8.8% of the individuals older than 80 years and, approximately, 40% of patients with rheumatic cardiac disease<sup>1</sup>.

Atrial fibrillation is a common complication of several heart diseases, but it has a tendency to develop in specific conditions, of which mitral valve disease is the most common<sup>2</sup>. Approximately 40% of patients with mitral stenosis and 75% of those with mitral regurgitation develop atrial fibrillation<sup>3</sup>, which is an arrhythmia accounting for 45% to 85% of systemic thromboembolism. The brain is the most frequently affected organ, being involved in more than 2/3 of the thromboembolic events; pulmonary thromboembolism is far less frequent<sup>3</sup>.

Treatment of atrial fibrillation associated with anticoagulation aims to regain sinus rhythm or the control of ventricular frequency. For this, in addition to pharmacological methods, interventional catheterization, implantable defibrillators, and surgery have been used. The Maze technique proposed by Cox et al<sup>4</sup> is the surgical procedure with the best results and has been used in several centers. More recently, the electrical isolation of pulmonary veins has been successfully proposed<sup>5</sup>. Prior to this, Graffigna et al<sup>6</sup> had already proposed left atrial isolation, a procedure in which the pulmonary veins were equally isolated.

Currently, several centers have performed mitral valve surgery associated with the Maze procedure and have been successful in 85% to 98% of the cases, in which reversion to atrial rhythm has been obtained<sup>7-9</sup>. Most patients undergoing mitral valve surgery and who have chronic atrial fibrillation do not revert to sinus rhythm with

the conventional postoperative treatment<sup>3</sup>. Jatene et al<sup>10</sup> reported in their study that 76.5% of the patients continued to have atrial fibrillation after surgical repair of the mitral lesion when this was not associated with the Maze procedure. These findings are in accordance with that of previous studies at our institution<sup>11</sup>.

According to the report by Cox et al<sup>12</sup> in 1999, the technique may eliminate the risk of thromboembolic phenomena associated with atrial fibrillation. Kosakai<sup>13</sup>, during a 7-year period, did not observe any cases of thromboembolism in patients who obtained reversion to sinus rhythm after the Cox procedure without placement of the valve prosthesis. On the other hand, in 400 patients undergoing the conventional technique with no valve prosthesis placement, 13 (3.25%) episodes of thromboembolism occurred. In Brazil, Jatene et al<sup>10</sup> observed no thromboembolic phenomenon in the postoperative period of a group of 20 patients, all of whom had undergone the Maze procedure. On the other hand, thromboembolism occurred in 20% of the 35 patients in the control group, who had undergone only valvar replacement.

With a 7-year experience with the Maze procedure<sup>14,15</sup>, we found it worth assessing the prevalence of late thromboembolism in this series of patients at our institution, correlating it with morbidity, heart rate, and the use of anticoagulant drugs. We also assessed the occurrence of thromboembolism in the postoperative period of the modified Cox 3 procedure for atrial fibrillation secondary to mitral valve disease.

## Methods

We carried out a retrospective review of the medical records and follow-up of 69 patients who had undergone the modified Cox 3 procedure for repair of atrial fibrillation and mitral valvuloplasty or mitral prosthesis placement, from January 1993 to July 1999 at the Instituto de Cardiologia do RS/Fundação Universitária de Cardiologia. The technical modification consisted of not using cryoablation, but more extensive dissection and electrocauterization.

The following parameters were analyzed: the patients' age, sex, valvar lesion, surgery performed (prosthesis or valvuloplasty), follow-up length, associated diseases, use of anticoagulation, complications or sequelae of embolism.

The mean age was 49.9±13.2 (20 to 77) years. The postoperative follow-up length ranged from 1 to 66 (mean of 31.7±19) months. Twenty-one (30.4%) patients were males and 48 were females (69.6%). The types of lesion were as follows: 33 (47.8%) mitral stenoses, 23 (33.3%) mitral insufficiencies, and 13 (18.8%) mitral double lesions (fig. 1). The surgeries performed were as follows: 64 (92.8%) valvuloplasties, 3 (4.3%) biological prosthesis placements, 2 (2.9%) mechanical prosthesis placements (fig. 2). In regard to thromboembolic events, 13% of patients (9) had had systemic embolisms prior to surgery as follows: 1 patient developed upper limb hemiparesis and left palpebral ptosis as a sequela; another patient developed dyslalia and weakness in the right lower limb; and another patient developed paresthesia in the right side of the face and in the left thumb. The 4<sup>th</sup> patient had dysphasia due to 2 episodes of cerebral em-

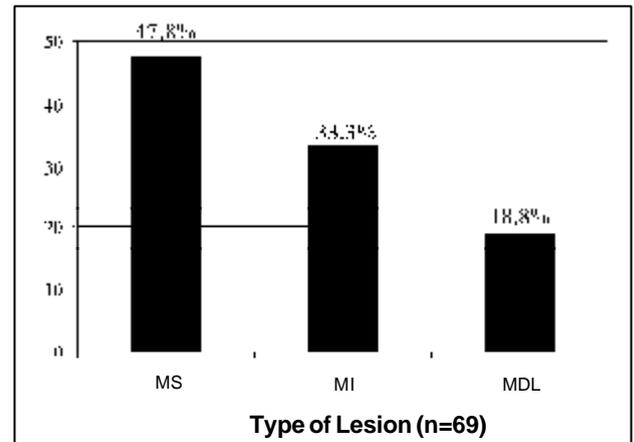


Fig. 1 – Mitral valvopathies classified according to predominance of the lesion. MS= mitral stenosis; MI = mitral insufficiency; MDL = mitral double lesion.

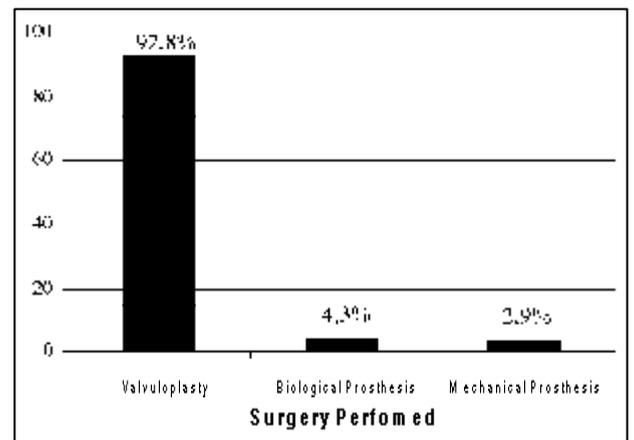


Fig. 2 - Type of surgery performed.

bolism. The remaining 5 patients had no sequelae. Two (2.9%) patients had left atrial thrombi detected on echocardiography (fig. 3). Our case series is shown in table I.

Sixteen patients received permanent postoperative anticoagulation, 6 of whom with atrial fibrillation and 10 with regular rhythm. The remaining 47 (74.6%) patients, 2 with atrial fibrillation and 45 with regular rhythm, did not undergo anticoagulation therapy (tab. I). The surgical staff did not recommend permanent postoperative anticoagulation because of previous atrial fibrillation. However, these 16 patients underwent anticoagulation either because of the presence of the prosthesis, or persistence of atrial fibrillation, or due to precaution, depending on the attending physicians.

## Results

The immediate mortality rate was 7.25% (5 patients), and the late mortality rate was 1.45% (1 patient) (tab. II and fig. 4). The late death resulted from pulmonary embolism followed by encephalopathy, after acute renal failure, which evolved to death due to multisystem organ failure in the 2<sup>nd</sup> postoperative month. Two (2.9%) patients were reoperated upon due to mitral lesion, as recurrence of mitral insufficien-

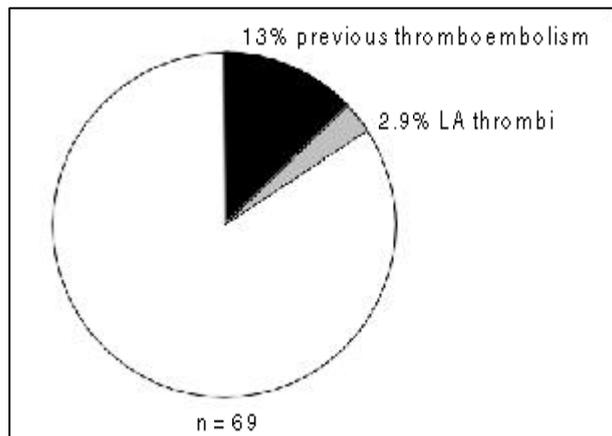


Fig. 3 - Preoperative thrombosis. LA = left atrium.

	n	%
Age (years)	49.9±13.2 (20 to 77)	-
Sex		
Male	21	30.4
Female	48	69.6
Lesion		
Mitral stenosis	33	47.8
Mitral insufficiency	23	33.3
Mitral double lesion	13	18.8
Surgery		
Valvuloplasty	64	92.8
Biological prosthesis	3	4.3
Mechanical prosthesis	2	2.9
Previous thromboembolism	9	13
Left atrial thrombi	2	2.9
Follow-up (months)	31.7±19	-

cy due to valvuloplasty failure, in the 10<sup>th</sup> and 59<sup>th</sup> postoperative months (tab. II). In regard to the current rhythm, 50 patients (73.5%) had sinus-atrial rhythm. At the time of the last clinical assessment, 10 (14.7%) patients had atrial fibrillation and 8 patients (11.8%) had atrioventricular pacemaker rhythm (tab. III and fig. 5).

A perioperative neurological lesion occurred and was followed by sepsis and death. No late systemic thromboembolism was observed (tab. II).

### Discussion

Atrial fibrillation is, in clinical practice, the most common sustained arrhythmia. Its presence almost doubles mortality and increases the risk of cerebral stroke 5 times, as compared with the mortality of the population without the arrhythmia. In patients with rheumatic mitral stenosis, the increase in the risk of cerebral stroke may reach 18 times<sup>1</sup>.

The major objective of our study was to assess the occurrence of late thromboembolism after the modified Cox 3 procedure, and to correlate it with clinical results and the permanent use of anticoagulation.

In regard to conversion to sinus or atrial rhythm, we found several reports in the literature, such as the study by Kim et al<sup>16</sup>, who reported a conversion rate to sinus rhythm

Events	N	%
Reoperations	2	2.9
Late thromboembolism	0	0
Immediate mortality	5	7.25
Late mortality	1	1.45

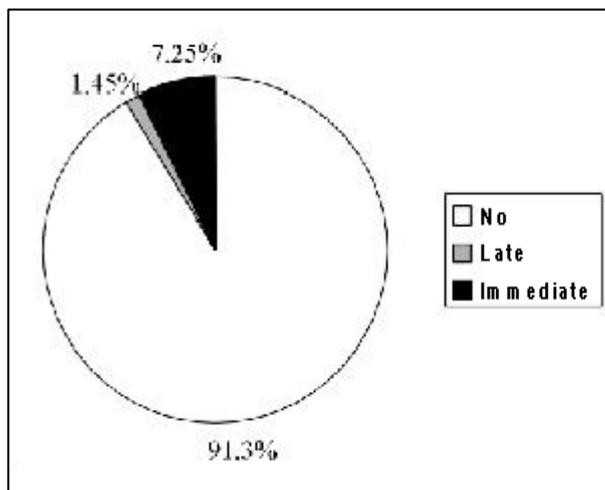


Fig. 4 - Immediate and late mortality.

Rhythm	Patients (N = 68)	%
Sinus/atrial	50	73.5
Atrial fibrillation	10	14.7
Pacemaker	8	11.8

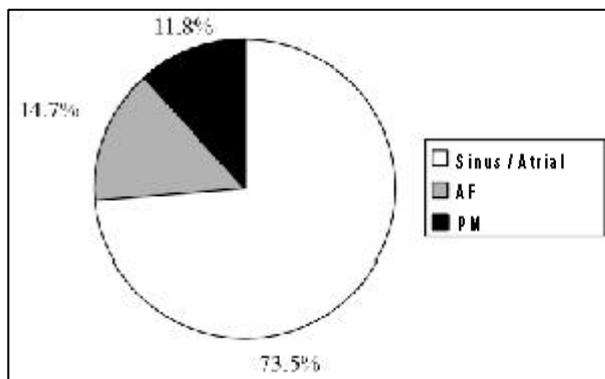


Fig. 5 - Postoperative rhythm in the last evaluation. AF = atrial fibrillation; PM = pacemaker

of 81% in patients who had undergone the Cox-Maze 3 procedure. Jatene et al<sup>10</sup>, in their study evaluating cardiac rhythm in a series of 20 patients, observed reversion of atrial fibrillation to regular rhythm in all patients. Of these 20 patients, 75% had sinus rhythm and 25% had junctional rhythm. McCarthy et al<sup>17</sup> reported a reversion to sinus rhythm of 100% during

ambulatory follow-up of at least 3 months. Our results show that 73.5% of patients had sinus-atrial rhythm at their last ambulatory visit, and 11.8% had atrioventricular pacemaker rhythm with consequent atrial contraction, resulting in 85.3% of atrial fibrillation reversion.

Cox et al<sup>12</sup>, in a series of 306 patients, reported a mortality of 3.3% in the immediate postoperative period and 1 intraoperative death. On the other hand, Kim et al<sup>16</sup> reported no deaths in their series of 32 patients. The same occurred with Kosakai et al<sup>18</sup>, who reported no deaths in the immediate and late postoperative period. McCarthy et al<sup>17</sup> reported a 7% mortality in the immediate postoperative period. Chua et al<sup>19</sup> reported an immediate postoperative mortality of approximately 2.5%. We observed a 7.2% immediate mortality and a 1.4% late mortality.

Cox et al<sup>12</sup> reported 2 (0.7%) patients with thromboembolic events during surgery, and, in 265 patients followed up for more than 11.5 years, 1 patient with thromboembolism with no sequelae. Jatene et al<sup>10</sup> reported no case of thromboembolism. Kosakai et al<sup>18</sup>, in a series of 62 patients, reported 1 episode of transient neurological ischemia in the late postoperative period. McCarthy et al<sup>17</sup> reported embolic events in 3 out of their 14 patients, who underwent only the Cox-Maze procedure. Chua et al<sup>19</sup> reported a 3.6%-incidence of thromboembolism in their series. In our study, we observed no late episodes of thromboembolism.

On the other hand, in regard to preoperative events, 58 (18.9%) patients in the series of Cox et al<sup>12</sup> had a history of thromboembolism prior to surgery. In our study, 9 (13%) patients had previous episodes of thromboembolism.

In patients undergoing the Cox-Maze procedure, the

permanent use of anticoagulation has been the object of discussion. Usually, anticoagulation is decided by the attending physician, even though surgeons do not recommend it as a routine measure.

In our series, 16 patients underwent anticoagulation. Kosakai et al<sup>18</sup> suspended the use of anticoagulation in 67% of their patients after surgical repair, corresponding to those who reverted to atrial rhythm. Cox et al<sup>12</sup> used anticoagulation in all patients with a mechanical prosthesis, who accounted for 40% of their sample. Chua et al<sup>19</sup> performed systemic anticoagulation in all their patients during the first 6 postoperative weeks, and this therapy was maintained in the patients who persisted with arrhythmia. These authors also reported that determining the risk of late thromboembolism according to the use of anticoagulant drugs was not possible. They concluded that repair of the mitral valve lesion through valvuloplasty increases conversion to sinus rhythm in the postoperative period and reduces the need for anticoagulation.

In conclusion, in our series, the Maze procedure was effective in establishing sinus rhythm or, at least, atrial rhythm, preserving the function of atrial transportation. During the period studied, no systemic thromboembolic episode occurred in the patients undergoing anticoagulation and in the majority of those not undergoing anticoagulation. Even though, we did not have a control group in our series, the occurrence of thromboembolism was lower than that expected according to data in the literature. Our experience allows us to infer that the Cox-Maze procedure may effectively prevent late thromboembolism after mitral valve repair in patients with previous chronic atrial fibrillation.

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