Concomitant ablation for atrial fibrillation during septal myectomy in patients with hypertrophic obstructive cardiomyopathy

Alexander V. Bogachev-Prokophiev, MD, Alexander V. Afanasyev, MD, Sergei I. Zheleznev, MD, Alexei N. Pivkin, MD, Michael S. Fomenko, MD, Ravil M. Sharifulin, MD, and Alexander M. Karaskov, MD

ABSTRACT

Objective: The appearance of atrial fibrillation is associated with significant clinical deterioration in patients with obstructive hypertrophic cardiomyopathy; therefore, maintenance of sinus rhythm is desirable. Guidelines and most articles have reported the results of catheter ablation and pharmacologic atrial fibrillation treatment; nevertheless, data regarding concomitant procedures during septal myectomy are limited. The aim of this study was to assess the outcomes of concomitant atrial fibrillation treatment in patients with obstructive hypertrophic cardiomyopathy.

Methods: Between 2010 and 2013 in our clinic, 187 patients with obstructive hypertrophic cardiomyopathy underwent extended myectomy. In 45 cases, concomitant Cox-Maze IV procedure was performed; however, obstructive hypertrophic cardiomyopathy was the primary indication for surgery. Atrial fibrillation was paroxysmal in 26 patients (58%) and nonparoxysmal in 19 patients (42%). The mean age of patients was 52.8 ± 14.2 years (range, 22-74 years). Mean peak gradient was 90.7 ± 24.2 mm Hg, and interventricular septum thickness was 26.1 ± 4.3 mm. Mean atrial fibrillation duration was 17.3 ± 8.5 months.

Results: There were no early deaths. No procedure-related complications occurred with regard to ablation procedure. Complete atrioventricular block was achieved in 2 patients (4.0%). Mean crossclamping time was 61 ± 36 minutes. Peak left ventricular outflow tract gradient was 12.6 ± 5.5 mm Hg based on transesophageal echocardiography. The Maze IV procedure was used for ablation in all patients (radiofrequency ablation with bipolar clamp + cryoablation for mitral and tricuspid lines). Because of the atrial wall thickness (5-6 mm), applications were performed 8 to 10 times on each line. There were no cases of pacemaker implantation due to sinus node dysfunction. All patients were discharged in stable sinus rhythm. Mean follow-up was 23.7 ± 1.3 months. The rate of atrial fibrillation freedom was 100% (45 patients) at 6 months, 89% (40 patients) at 1 year, and 78% (35 patients) at 24 months.

Conclusions: Concomitant ablation atrial fibrillation during septal myectomy in patients with obstructive hypertrophic cardiomyopathy is a safe and effective procedure and should be considered carefully in this patient group. (J Thorac Cardiovasc Surg 2018;155:1536-42)

Rhythm disturbances after surgical ablation in patients with HCM.

Central Message

Concomitant surgical AF ablation may be considered for patients with HCM and AF who are scheduled for surgical myectomy.

Perspective

Appearance of AF is associated with significant clinical deterioration in patients with HCM. Our study showed that the concomitant Maze IV procedure during septal myectomy effectively eliminates AF and improves functional capacity and quality of life.

See Editorial Commentary page 1543.

From Heart Valves Surgery Department, Siberian Biomedical Research Center, Novosibirsk, Russian Federation.

The study was approved by the local Ethical Committee at December 1, 2009, approval number PA-448.

Received for publication Dec 7, 2016; revisions received Aug 2, 2017; accepted for publication Aug 23, 2017; available ahead of print Sept 22, 2017.

Address for reprints: Alexander V. Afanasyev, MD, 15 Rechkunovskaya St, Novosibirsk 630055, Russian Federation (E-mail: av.afanasyev@icloud.com).

0022-5223/\$36.00

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<http://dx.doi.org/10.1016/j.jtcvs.2017.08.063>

Abbreviations and Acronyms

AF	= atrial fibrillation
CI	= confidence interval
HCM	= hypertrophic cardiomyopathy
LVOT	= left ventricular outflow tract
MR	= mitral regurgitation
OR	= odds ratio

Scanning this QR code will take you to the supplemental figures, tables, and video for this article.

Hypertrophic cardiomyopathy (HCM) is a genetic disease with increasing left ventricle wall thickness, morphologic abnormalities of mitral valve apparatus, and progressive heart failure.^{1,2} Left ventricular outflow tract (LVOT) obstruction, systolic anterior motion, and mitral regurgitation (MR) lead to high left atrial pressure and dilatation, increasing the risk of atrial fibrillation (AF).³⁻⁵ The prevalence of AF in patients with HCM is approximately 18% to 25%.^{4,6} The appearance of AF increases long-term mortality and the incidence of thromboembolic events, and significantly reduces quality of life.^{5,7} AF with irregular tachysystolic rhythm in patients with HCM leads to loss of atrial contraction and reduced filling time to intensify left ventricle diastolic dysfunction in those with HCM. Pharmacologic therapy and radiofrequency catheter ablation are widely used for the maintenance of sinus rhythm in such patients.^{2,7-9} Antiarrhythmic drug therapy has minimal evidence and low efficiency for sinus rhythm restoration.⁸ Radiofrequency catheter ablation has been proven effective for AF treatment in patients with HCM; however, the rate of AF recurrence is high, ranging from 48% to 72% after a single ablation procedure.^{2,7-9} Data regarding concomitant surgical AF treatment during septal myectomy in patients with obstructive HCM are limited.¹⁰ Our objective was to assess the effectiveness and safety of concomitant Maze IV procedure during septal myectomy in patients with obstructive HCM.

MATERIALS AND METHODS**Patient Characteristics**

Patient recruitment for the study was prospective with continuous observation. End points were freedom from AF recurrence, LVOT gradients, New York Heart Association class, and quality of life assessed with the Short Form-36 questionnaire. The local Ethical Committee approved this study, and all patients provided written informed consent. The present study was conducted in compliance with the Declaration of Helsinki.

Between January 2010 and May 2013, 187 patients underwent extended myectomy procedures. In 45 patients (24.1%), concomitant AF ablation was performed (Consort diagram shown in [Figure E1](#)). Mean age of patients was 52.8 ± 14.2 years (range, 22-74 years) ([Table 1](#)). Obstructive HCM was the primary indication for surgery according 2011 American College of Cardiology Foundation/American Heart Association guidelines.

Surgical Technique

In all procedures, exposure was achieved through a midline sternotomy with standard cardiopulmonary bypass, bicaval cannulation, and mild hypothermia (33°C-34°C). For myocardial protection, cold cardioplegic crystalloid solution was used (Custodiol Dr Kohler Pharma, Alsbach-Hahnlein, Germany) with antegrade root flow. Transaortic extended myectomy was performed in all cases using the operative technique previously described by Morrow¹¹ and modified by Messmer¹² ([Figure 1, A](#)). Cox-Maze IV procedure included ablation lines created by using an Isolator Synergy bipolar device (AtriCure, Inc, Cincinnati, Ohio) with applications 8 to 10 times at each line ([Figure 2, A and B](#)), and cryolesions created by applying cryoICE cryoablation probes (AtriCure, Inc) to the mitral and tricuspid annulus ([Figure 1, B](#)). The left atrial appendage was excluded using an external double-layer 4/0 polypropylene suture in all cases. Mitral valve intervention (repair or replacement) was performed in all cases.

Exit and entrance block of the pulmonary veins (electrophysiologic disconnection of the pulmonary veins from the left atrium during pacing) and for the posterior left atrium wall ("box lesion") were assessed immediately before bypass weaning in all patients using monopolar stimulation probe.

To assess residual MR, systolic anterior motion syndrome, and LVOT obstruction after the procedure, intraoperative transesophageal echocardiography was used. Rapid dual-chamber or atrial pacing (in cases of adequate atrial valve conductance) with 80 to 86 beats/minute was established in all patients. For further information, see the intraoperative [Video 1](#) with subtitles available online.

Drug Management

Maintenance antiarrhythmic therapy consisted of amiodarone 600 to 1200 mg before the operation and 200 mg per day for 3 months postoperatively. Antiarrhythmic medication was discontinued at the end of the blanking period (3 months) after rhythm monitoring. During the follow-up period in patients with AF recurrences, we restarted amiodarone in paroxysmal patients. The decision to stop anticoagulation therapy with Coumadin in patients without mechanical prostheses was based on echocardiography (completeness of left atrial appendage closure, presence of atrial contractility) and Holter data after 6 months. Patients with a mechanical mitral valve were kept on lifelong anticoagulation therapy. Nonvasodilating β -blockers were prescribed for all patients after surgery.

Cardiac Rhythm Assessment

Patient follow-up examinations were scheduled every 6 months postoperatively at our outpatient department or the referring cardiologist's office. The primary end point of this study was freedom from atrial arrhythmia recurrence, defined as any documented AF, atrial flutter, or atrial tachycardia episode lasting more 30 seconds after a 3-month blanking period. Cardiac rhythm was monitored with 72-hour Holter monitoring in all patients.

Statistical Analysis

Shapiro-Wilk's W test was used to check for normality of continuous variables. Continuous data are presented as mean $\pm$ standard deviation, and categorical variables are expressed as proportions and percentages. Preoperative and postoperative variables were compared using the paired *t* test (normally distributed continuous variables) or McNemar's test (categorical variables). Longitudinal changes were analyzed by 1-way analysis of

TABLE 1. Baseline characteristics

Parameters	Total (n = 45)	Paroxysmal AF (n = 26)	Persistent AF (n = 19)
Age (y, mean $\pm$ SD)	52.8 $\pm$ 14.2	51.4 $\pm$ 11.3	53.1 $\pm$ 14.9
Female, n (%)	28 (62.2)	17 (65.3)	11 (57.9)
BMI (kg/m ² , mean $\pm$ SD)	29.3 $\pm$ 5.9	29.6 $\pm$ 4.8	30.1 $\pm$ 5.6
NYHA class (%)			
I	3 (6.7)	3 (11.5)	0
II	14 (31.1)	8 (30.8)	6 (31.6)
III	23 (51.1)	13 (50.0)	10 (52.6)
IV	5 (11.1)	2 (7.7)	3 (15.8)
AF type (%)			
Paroxysmal, n (%)	26 (57.7)	26 (100)	-
Persistent, n (%)	11 (24.4)	-	11 (57.9)
Long-standing persistent, n (%)	8 (17.7)	-	8 (42.1)
Mean AF duration (mo, mean $\pm$ SD)	17.3 $\pm$ 8.5	10.6 $\pm$ 5.2	21.0 $\pm$ 5.9
Previous ASA therapy, n (%)	-	-	-
Previous catheter ablation for AF, n (%)	6 (13.3)	3 (11.5)	3 (15.8)
euroSCORE II, %	1.5 $\pm$ 0.4	1.5 $\pm$ 0.5	1.6 $\pm$ 0.3
5-y risk of SCD, %	5.7 $\pm$ 0.6	5.8 $\pm$ 0.7	5.6 $\pm$ 0.4

AF, Atrial fibrillation; SD, standard deviation; BMI, body mass index; NYHA, New York Heart Association; ASA, alcohol septal ablation; euroSCORE, European System for Cardiac Operative Risk Evaluation; SCD, sudden cardiac death.

variance with repeated measures. Preoperative and perioperative variables were evaluated to identify risk factors for atrial arrhythmia recurrence. Linear mixed-effects models with fixed (time) and random (subject) effects were used for analysis of treatment by time interactions. On the basis of Mauchly's test, the assumption of sphericity was considered as valid for all mixed-effects models. After establishing overall significance of a model, Tukey's all-pair post hoc comparisons with adjustment for multiplicity were carried out. Subgroup analyses were performed with the use of Cox proportional-hazards regression; the interaction of each subgroup factor and treatment was tested. Stata/MP for Windows v. 13.0 (StataCorp. 2013. *Stata Statistical Software: Release 13*. StataCorp LP, College Station, Tex) was used for the statistical analysis.

RESULTS

Mitral valve repair and replacement were performed in 19 patients (42.2%) and 5 patients (11.1%), respectively. Mitral valve repair included papillary muscle mobilization

in 19 patients (100%), secondary chord (from 2 to 6) resection in 19 patients (100%), longitudinal papillary muscle resection (in cases with papillary muscles exceeding 15 mm) in 12 patients (63.1%), and excision of abnormal papillary muscles in 1 patient (5.3%). Mean crossclamp and ablation times were 61.7 $\pm$ 26.2 minutes and 28.8 $\pm$ 7.2 minutes, respectively.

Intraoperative testing in all 6 patients who underwent previous catheter AF ablation did not confirm pulmonary vein isolation from the previous procedure. Sensing and pacing maneuvers verified isolation of pulmonary veins and posterior box in all patients without requirement of any repeated ablation. A consolidated conduction block was successfully achieved in all patients after the procedure.

FIGURE 1. Intraoperative view: A, Transaortic extended myectomy. B, Inferior left atrial wall thickness and “mitral” cryoablation. RCC, Right coronary cusp; PM, papillary muscle; LVV, left ventricle vent; SCMV, secondary cord of mitral valve; AML, anterior mitral leaflet; LA, left atrium.

FIGURE 2. Scheme of lesion set: A, Left atrial lesion set included bipolar radiofrequency pulmonary vein isolation with connection creating “box lesion” and a mitral isthmus endo-epicardial cryothermal lines. B, The right vertical atriotomy performed from crista terminalis toward atrioventricular groove. Right atrial lesion set with superior-inferior vena cava bipolar radiofrequency lines and cryolesion to the tricuspid valve annulus from atriotomy.

There were no early deaths. Peak LVOT gradient after the procedure according to transesophageal echocardiography and direct measurement was 12.6 ± 5.5 mm Hg and 10.2 ± 4.4 mm Hg, respectively (Table 2). One patient was reexplored for bleeding. We did not observe any specific AF ablation-related complications or postoperative cerebral ischemic events. Thirty-one patients (68.9%) had a transit sinus node dysfunction with complete recovery at 4 to 10 days after surgery. Early AF paroxysm recurrence was observed in 2 patients (4.4%) and pharmacologically cardioverted with amiodarone. We did not have any patients with a preexisting dual-chamber pacemaker. Complete atrial valve block was the main complication of extended myectomy, which necessitated pacemaker implantation in 2 patients (4.4%). We interrogated pacemakers in those 2 patients and did not reveal any AF paroxysms. Left bundle branch block was detected in 34 patients (75.5%).

Hospital length of stay was 12.4 ± 2.4 days. Stable sinus rhythm was documented in 43 patients at discharge, and 2 patients had pacemaker rhythm with P-wave pacing.

VIDEO 1. Transaortic extended myectomy and Cox-Maze IV procedure. Video available at: [http://www.jtcvsonline.org/article/S0022-5223\(17\)31825-1/fulltext](http://www.jtcvsonline.org/article/S0022-5223(17)31825-1/fulltext).

The mean follow-up period was 23.7 ± 1.3 months. Holter ECG was performed in all patients at 12 months and in 87% ($n = 39$) at 24 months. One sudden cardiac death (2.2%) occurred 12 months postmyectomy. One noncardiac death (malignancy) occurred 4 years after surgery. Patients who died underwent a pathoanatomic examination, and autopsy protocol was obtained.

The repeated-measures analysis of variance revealed significant changes in echocardiographic results (Table 2). At 24-month follow-up, the left ventricular end-diastolic volume was increased, the LVOT gradient was decreased to 11.3 ± 6.4 mm Hg, and basal septal thickness was decreased to 15.2 ± 2.8 mm compared with values before surgery ($P < .01$). There are no significant (grade ≥ 2) MR recurrences. At the 2-year follow-up, $86.5\% \pm 5.1\%$ of patients (95% confidence interval [CI], 72.4-93.7) were free from AF recurrence and any antiarrhythmic drugs. Cardiac rhythm statuses during sequential 3-month, 6-month, 12-month, 18-month, and 24-month points after surgery are shown in Table E1 and illustrated in Figure 3. Rates of AF freedom at each time point were 100% (45 patients) at 6 months, 93.3% (42 patients) at 1 year, and 82.2% (37 patients) at 24 months. Post hoc pairwise comparison revealed that differences in freedom from atrial tachyarrhythmias at 24 months versus discharge/3/6 months were significant. There was no significant different in freedom from AF/atrial flutter/atrial tachycardia between the paroxysmal and persistent subsets through 24 months (Figure 4).

Six patients with AF recurrences at follow-up had paroxysmal rhythm disturbances, and they were primarily in sinus rhythm according to 72-hour Holter. Among them, 4 patients had recovered sinus rhythm, and 2 patients had observed AF paroxysm at the next examination. Only 2 patients had long-standing persistent AF. We decided to use rate control instead of rhythm control drug management for these 2 patients. Five patients with a mechanical mitral valve were kept on lifelong anticoagulation therapy.

TABLE 2. Echocardiographic data

Parameters	Preoperative, n = 45	Intraoperative, n = 45	At discharge, n = 45	24 mo, n = 44
LVEF (%; mean $\pm$ SD)	76.2 $\pm$ 7.5	64.5 $\pm$ 5.6*	62.8 $\pm$ 7.1*	67.5 $\pm$ 5.5*
LVEDV (mL; mean $\pm$ SD)	73.6 $\pm$ 24.0	82.9 $\pm$ 29.2*	91.1 $\pm$ 20.9*	98.4 $\pm$ 31.6*
LA size (cm; mean $\pm$ SD)	4.4 $\pm$ 1.7	4.9 $\pm$ 0.5	4.5 $\pm$ 0.5	4.2 $\pm$ 0.6
LVOT gradient (mm Hg; mean $\pm$ SD)	90.7 $\pm$ 24.2	12.6 $\pm$ 5.5*	11.2 $\pm$ 3.9*	11.3 $\pm$ 6.4*
Basal septal thickness (mm; mean $\pm$ SD)	26.1 $\pm$ 4.3	14.1 $\pm$ 2.5*	14.8 $\pm$ 3.4*	15.2 $\pm$ 2.8*
Mild MR, n (%)	9 (20)	45 (100)*	45 (100)*	44 (100)*
Moderate MR, n (%)	21 (46.7)	0*	0*	0*
Severe MR, n (%)	15 (33.3)	0*	0*	0*

LVEF, Left ventricular ejection function; SD, standard deviation; LVEDV, left ventricular end-diastolic volume; LA, left atrial; LVOT, left ventricular outflow tract; MR, mitral regurgitation. * $P < .01$ compared with values before surgery.

Mixed model identified that age (odds ratio [OR], 1.003; 95% CI, 1.002-1.004) and preoperative LVOT gradient (OR, 0.9991; 95% CI, 0.9982-0.9999) were associated with greater risk for AF recurrences (Tables 3 and E2).

At the 2-year follow-up, most patients were in New York Heart Association class I or II (Figure E2). Quality of life assessed at the 1-year follow up with the Short Form-36 questionnaire revealed a significant postoperative improvement in all physical health (44.3 ± 10.1 to 69.0 ± 14.2) and mental domains (43.9 ± 19.4 to 64.8 ± 20.1) ($P < .001$) (Figure 5).

DISCUSSION

This study presents the results of concomitant AF ablation in patients with obstructive HCM. The Cox-Maze III procedure in patients with cardiac disease and AF who underwent concomitant interventions was previously reported to achieve a success rate of more than 95% sinus rhythm restoration at 10 years.¹³ Modification of the Cox-Maze III procedure by eliminating the traditional “cut and sew” approach has been proposed as the Maze IV technique. The main aim of this procedure was to simplify and shorten

the operation without reducing short-term efficacy, as was supported by a prospective, single-center clinical trial.¹³ Despite the excellent results of the Maze IV procedure for concomitant AF treatment, data from patients with obstructive HCM scheduled for myectomy are limited.

The first report of the concomitant Maze procedure during extended myectomy was published in 2004 by Chen and colleagues¹⁰ from the Cleveland Clinic, who reported only a 60% freedom from AF recurrence after 15 months based on a limited series of 10 patients. Bassiouny and colleagues¹⁴ published the largest retrospective analysis of nonpharmacologic AF treatment in patients with HCM. They obtained more optimistic results after concomitant ablation, with 74% and 68% AF freedom for 1 and 2 years, respectively. However, the surgical techniques used in that study were varied, including complete “cut and sew” Maze III, modified procedures using cryothermia or radiofrequency energy, and lone pulmonary vein isolation by applying a bipolar clamp.

In the present study, we achieved an 82.2% rate of sinus rhythm preservation at 24-month follow-up, which is substantially higher than in other studies. The low success

FIGURE 3. Rhythm disturbances after concomitant surgical ablation in patients with HCM and AF at different time points. AF, Atrial fibrillation; AFI, atrial flutter; AT, atrial tachycardia.

FIGURE 4. Two-year follow-up comparing freedom from AF after a concomitant Cox-Maze IV procedure and extended myectomy for paroxysmal and persistent AF. AF, Atrial fibrillation.

TABLE 3. Mixed models analysis for atrial fibrillation recurrence

Variable	HR	95% CI	P value
AF type	0.99	0.97-1.02	.764
LVOT gradient	0.9991	0.9982-0.9999	.046
Septum	0.98	0.94-1.03	.516
Posterior wall	0.96	0.91-1.02	.171
NYHA	0.98	0.96-1.01	.174
Male	1.04	0.99-1.09	.076
Age	1.003	1.002-1.004	.009
Visit	1.01	1.001-1.02	.025

HR, Hazard ratio; CI, confidence interval; AF, atrial fibrillation; LVOT, left ventricular outflow tract; NYHA, New York Heart Association.

rate of concomitant AF ablation is associated with hypertrophy of atrial myocytes,¹⁵ which is common in HCM and does not allow achieving the complete transmural lesion during the procedure. This fact is confirmed by the observation of pulmonary vein conduction recovery on repeat catheter ablation in most patients who had undergone modified Maze or limited pulmonary vein isolation with cryotherapy/radiofrequency energy but not in patients who underwent the “cut and sew” procedure.¹⁴ Reconnection is not rare even in patients with mitral valve disease along with dilatation and thinning of the atrial wall¹⁶ and can be a more significant problem in cases of severe atrial hypertrophy leading to failure of the ablation procedure. In our study, we also revealed failure of previous catheter pulmonary vein isolation in all cases.

We believe that the high success rate in our series is based on features of the ablation procedures. In all cases, we performed the complete Maze IV procedure with bipolar clamps and cryolesions for mitral and tricuspid lines instead of more limited schemes, such as left atrial mini-Maze or isolation pulmonary veins alone. We performed multiple

applications (up to 10) with the bipolar clamp because the atrial wall thickness exceeded 5 mm and could be a cause of incomplete transmural lesion postoperatively.

Predictors associated with a lower likelihood of success after concomitant AF ablation are well known. Cox regression analysis in the study by Bassiouny and colleagues¹⁴ confirmed them for patients with HCM: AF duration (OR, 0.66; 95% CI, 0.49-0.90; $P = .008$) and AF type (persistent and long-standing persistent) (OR, 0.38; 95% CI, 0.17-0.88; $P = .024$).¹⁴ In our study, older age was associated with a greater risk for AF recurrence during follow-up.

Sinus node dysfunction requiring permanent pacemaker implantation is another negative outcome of the concomitant Maze procedure, occurring in 6% to 13% of cases within 30 days after the procedure and 6% to 10% of cases at 1-year follow-up.¹⁷ Robertson and colleagues¹⁷ reported that only age was an independent predictor for permanent pacemaker insertion (OR, 1.10; 95% CI, 1.06-1.14; $P < .001$). In another study, demographic data did not affect the pacemaker implantation rate; however, biatrial procedures were associated with significantly increased rates of sinus node dysfunction compared with isolated left-sided ablation (6.3% vs 13.6%; $P = .028$).¹⁸ In the present study, we performed a biatrial Maze procedure in all cases but did not observe any incidents of permanent sinus node dysfunction. This result could be explained by young age of patients in this cohort (52.8 ± 14.2 years) and possibly nonrheumatic AF reason without long duration (17.3 ± 8.5 months).

At the 2-year follow-up, we observed improvement of functional status, absence of LVOT obstruction recurrence, and MR 2+ or greater. We also found improvement in the quality of life 1 year after surgery, which is consistent with other reports.^{10,12,14} In our HCM subset, freedom from recurrent atrial tachyarrhythmias after concomitant Cox-Maze IV procedure at 2 years was 82%, which looks

Dynamics of the quality of life			
	Preoperative (n = 45)	12 months (n = 44)	p Value
GH	41.5 ± 13.8	61.3 ± 5.1	< 0.001
PF	56.4 ± 26.2	78.6 ± 7.4	< 0.001
RP	27.2 ± 29.6	74.1 ± 13.4	< 0.001
RE	45.2 ± 30.5	81.1 ± 11.1	< 0.001
SF	35.7 ± 7.4	50.3 ± 8.7	< 0.001
BP	49.6 ± 13.7	67.4 ± 11.6	< 0.001
VT	44.5 ± 10.2	62.6 ± 12.3	< 0.001
MH	49.1 ± 6.1	62.5 ± 7.3	< 0.001

FIGURE 5. Quality of life component scores preoperatively and at 12-month follow-up. GH, General health; MH, mental health; PF, physical functioning; VT, vitality; RP, role-physical functioning; BP, bodily pain; RE, role-emotional; SF, social functioning.

similar to the rheumatic and degenerative cohort (90% and 80%, respectively) at the same time point.¹⁹

Study Limitations

This study included a limited number of patients without a control group; moreover, 72-hour Holter monitoring instead of continuous loop recording was used. We did not precisely examine an atrial transport function, which might affect the results, especially in those with paroxysmal AF. The study results can be considered for patients with HCM with a 2-year follow-up period. Longer-term follow-up results are needed.

CONCLUSIONS

Concomitant Maze IV procedure during septal myectomy in patients with obstructive HCM was able to safely and effectively eliminate AF, improving functional capacity and quality of life. Concomitant surgical AF ablation may be considered for patients with HCM with AF who are scheduled for myectomy.

Conflict of Interest Statement

Authors have nothing to disclose with regard to commercial support.

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Key Words: atrial fibrillation, hypertrophic cardiomyopathy

FIGURE E1. Consort flow diagram. *HOCM*, Hypertrophic obstructive cardiomyopathy.

FIGURE E2. New York Heart Association functional class preoperatively and at 24-month follow-up.

TABLE E1. Rhythm outcomes

AF type	Rhythm	At discharge	3 mo	6 mo	12 mo	18 mo	24 mo
Paroxysmal	Sinus	26	26	26	25	26	24
	AF/AFI/AT	0	0	0	1	0	2
Persistent	Sinus	19	19	19	17	15	13
	AF/AFI/AT	0	0	0	2	3	5
Overall	Sinus	45	45	45	42	41	37
	AF/AFI/AT	0	0	0	3	3	7

AF, Atrial fibrillation; AFI, atrial flutter; AT, atrial tachycardia.

TABLE E2. Variables that were tested as potential risk factors for atrial fibrillation recurrence

Variable	Specification
Patient age	Continuous variable, y
Gender	Male, female
Preoperative NYHA class	From I to IV
AF type	Paroxysmal, persistent
Preoperative LVOT gradient	Continuous variable, mm Hg
Preoperative basal septum thickness	Continuous variable, mm
Posterior LV wall thickness	Continuous variable, mm
Visit	Discharge, 3, 6, 12, 18, 24 mo

NYHA, New York Heart Association; AF, atrial fibrillation; LVOT, left ventricular outflow tract; LV, left ventricle.