

A high quality of life is maintained late after Maze III surgery for atrial fibrillation

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Received 25 September 2008; received in revised form 21 April 2009; accepted 22 April 2009; Available online 10 June 2009

Abstract

Background: Cox Maze surgery for atrial fibrillation (AF) has been found to have high efficacy in maintaining sinus rhythm and has been shown to improve quality of life early after surgery, but reports on long-term effects in this respect are lacking. This study was therefore undertaken to evaluate the effect of the Maze procedure on health-related quality of life in the long term. **Methods:** Patients with drug-refractory AF undergoing the ‘cut and sew’ Maze III procedure without any modification were assessed with the SF-36 Health Survey regarding quality of life at baseline and late after surgery. Totally 61 patients, mean age 55 years (range: 29–74 years), were evaluated. At the time of surgery, 34 patients (56%) had paroxysmal or persistent AF and the remainder had permanent AF. **Results:** At late follow-up, at a mean of 55 ± 12 months, 54 patients (89%) were free from AF recurrences and another five patients (8%) had experienced only one or a few AF episodes. All eight scales on the SF-36 Health Survey were significantly improved at long-term follow-up compared to baseline. The quality-of-life improvement was seen both in patients with paroxysmal/persistent AF and in those with permanent AF. At long-term follow-up, the quality-of-life scores were comparable with those of the general population. **Conclusions:** The Cox Maze III procedure has good long-term efficacy for rhythm control in patients with medically refractory AF, resulting in a quality-of-life improvement, which is maintained late after surgery.

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Keywords: Atrial fibrillation; Arrhythmia surgery; Quality of life

1. Introduction

Atrial fibrillation (AF) is the most common clinical arrhythmia. The symptoms related to this condition vary widely among patients. A subset of patients experiences a severely depressed quality of life. Pharmacological therapies for AF have limited efficacy and, as a consequence, several non-pharmacological treatments have been developed. The Cox Maze III procedure was introduced in 1995 as a potentially curative therapy for AF among patients with intolerance to anti-arrhythmic medication or in whom medical therapy had failed [1]. In many studies the Maze procedure has shown a high efficacy rate with freedom from AF in >90% at follow-up [2–8]. This procedure is an extensive surgical operation however, and relief of symptoms does not automatically translate into an improved health-related quality of life. However, in a previous study by our group, it was found that health-related quality of life was improved 6 and 12 months after Maze surgery compared to the baseline scale scores, and the scores reached the values for the age-

matched general population [9]. In contrast, the long-term effects of the Maze procedure on the quality of life are not known.

Today, pulmonary vein ablation is the first-line therapy for paroxysmal or persistent AF if medication fails. The success rate in experienced hands is 75–85% [10–12], leaving 15–25% of the ablated population with symptomatic AF. The role of catheter ablation in patients with permanent AF is presently not clear. We therefore believe that there still is a role for Maze surgery in selected patients.

The purpose of this study was to evaluate the long-term effects on health-related quality of life as assessed by the SF-36.

2. Materials and methods

2.1. Patients

We studied 74 consecutive Swedish patients with drug-refractory, severely symptomatic AF who underwent the Cox Maze III procedure at our institution between February 1996 and May 2000. In all patients, the primary indication for surgery was intolerable AF despite maximal pharmacological treatment. No patient had previously undergone a catheter

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Table 1
Clinical characteristics of the 61 patients.

Age (years \pm 1SD)	55 \pm 13 (range 29–74)
Males/females (n)	48/13
Paroxysmal or persistent AF (n)	34 (56%)
AF duration, years (mean \pm 1SD)	10.3 \pm 7
Antiarrhythmic drugs tried (mean \pm 1SD)	4.5 \pm 1.5
Hypertension (n)	10 (16%)
Diabetes mellitus (n)	2 (3%)
Prior TIA/stroke (n)	5 (8%)
Ischemic heart disease (n)	6 (10%)
Valvular heart disease (n)	5 (8%)

Abbreviations: AF, atrial fibrillation; n, number of patients; TIA, transitory ischemic attack.

ablation procedure for AF as the method at that time had not gained widespread use.

The clinical characteristics of the population are described in Table 1. The majority of the patients had lone AF. It was characterised as paroxysmal or persistent in 34 (56%) and as permanent in 27 (44%) based on clinical history and repeated 12-lead ECG. We defined AF as paroxysmal if the AF episodes converted spontaneously within 7 days, as persistent if pharmacological therapy or electrical cardioversion had to be used to terminate AF and as permanent if electrical cardioversion failed to restore sinus rhythm or AF recurred shortly after repeated electrical cardioversions.

The standard Maze III procedure, described elsewhere [1], was completed in all patients without any modification. The 'cut and sew' technique was used for all lesions. To secure electric isolation where the incision lines ended at the tricuspid and mitral annuli, completing cryo lesions were placed there. Eleven patients underwent concomitant surgical procedures in addition to the Maze procedure: coronary artery bypass grafting (n = 4), mitral valve repair (n = 4), tricuspid valve repair (n = 1), closure of an atrial septal defect (n = 1) and ascending aorta grafting (n = 1).

2.2. Clinical follow-up

All patients were followed up at our outpatient clinic 6 months after surgery; thereafter all anti-arrhythmic drugs were discontinued. Warfarin was also discontinued unless the patient had recurrent symptomatic AF, AF at ECG or had an indication other than AF. At late follow-up, at a mean of 55 \pm 12 months after Maze surgery (range: 35–91 months), all patients were asked about symptoms, the current medication and a 12-lead ECG were recorded and the quality of life was assessed. Quality of life could not be evaluated in 13 patients due to the following reasons: not alive = 5, unwilling/too ill to participate = 3, incomplete questionnaires at baseline or follow-up = 5. Of the five dead patients, two had died during Maze surgery, two after surgery because of lung cancer and one patient with severe hypertrophic cardiomyopathy died suddenly 1 year after surgery. The four patients living out of Sweden did not speak Swedish and no SF-36 exists in their native language, and thus quality of life could not be evaluated. Of the remaining three patients without complete late follow-up, one could not be evaluated due to a terminal cancer disease, and the other two refused to come because they lived far away. In a later mail survey these two patients answered that none of them had

experienced any late complications; one patient had had a single symptomatic AF episode but the other patient was free of symptomatic AF episodes. The study population therefore consists of 61 patients.

Quality of life was assessed with a self-administered questionnaire handed out by a research nurse prior to the Maze operation and at the long-term follow-up visit. The Swedish SF-36 Health Survey was used. The questionnaire was produced within the framework of the international Quality of Life Assessment (OQOLA) project to match the original US Medical Outcomes Study Short-Form (SF-36) Health Survey Manual and Interpretation Guide [13]. We used the SF-36 Health Survey because it is well validated, covers a broad range of quality-of-life dimensions and has been widely applied in quality-of-life studies regarding AF therapies. Furthermore, normative data for the Swedish population have been published [14,15]. The health questionnaire measures eight variables: physical functioning, role limitation due to physical problems, bodily pain, general health, vitality, social functioning, role limitation due to emotional problems and mental health. Scores were converted to a scale ranging from 0 to 100, with a higher score representing better quality of life. We used standard rules for recording the items and handling of missing data (<0.5%).

The authors had full access to the data and take responsibility for its integrity. They have read and agree to the article as written.

The study complies with the Declaration of Helsinki and the Regional Ethics Review Board approved the research protocol. All patients gave informed consent to participate in the study.

2.3. Statistical analysis

Student's paired, two-tailed *t*-test was used for comparison within groups and Student's unpaired *t*-test was used for comparisons between the groups. Differences were considered significant at *p* < 0.05. Unless otherwise specified, results are expressed as mean \pm 1 standard deviation (SD).

3. Results

The Maze III procedure was completed in all patients. At follow-up, 55 \pm 12 months after surgery, all patients were in sinus rhythm and 54 of the 61 patients (89%) had been completely free from symptomatic AF recurrences without any anti-arrhythmic drugs since the early postoperative period (30 days). Five patients (8%) had experienced one or a few ECG-verified AF episodes, but only one patient was on an anti-arrhythmic drug (sotalol). Two patients had had more than five symptomatic AF episodes per year. The mean duration between the Maze procedure and the first AF recurrence was 32 months, with a range of 12–45 months.

3.1. Quality of life

The quality-of-life scores at baseline were markedly and significantly lower on all scales, except for bodily pain, than the scores for the age-matched general Swedish population (Fig. 1).

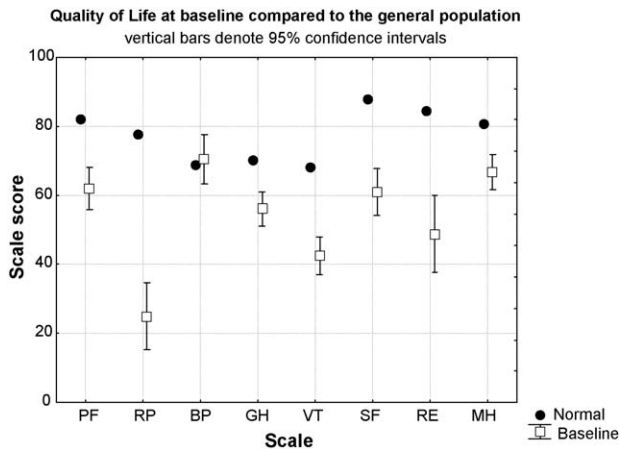


Fig. 1. Quality of life scores, assessed by SF-36, in patients with AF before Maze surgery (baseline) compared to the age-matched general Swedish population. Vertical bars indicate 95% confidence intervals. PF, physical functioning; RP, role limitation owing to physical problems; BP, bodily pain; GH, general health; VT, vitality; SF, social functioning; RE, role limitation owing to emotional problems; and MH, mental health.

At long-term follow-up, all SF-36 scores had improved significantly compared to the baseline values (see Table 2). The greatest improvements were seen in role limitation due to physical problems and vitality. The quality-of-life values obtained at long-term follow-up were comparable to the values for the age-matched general Swedish population (Fig. 2). The quality-of-life measurements for the 51 patients who did not undergo any concomitant cardiac surgery were analysed separately. The improvement in quality of life was as dramatic as in the entire population and highly significant for all variables except bodily pain. The SF-36 values at baseline versus at late follow-up in the population not undergoing any concomitant surgery were: PF 63.4 ± 23.7 versus 81.8 ± 19.3 , $p < 0.0001$, RP 23.0 ± 34.6 versus 76.0 ± 37.1 , $p < 0.0001$, BP 69.8 ± 26.4 versus 77.3 ± 26.2 , $p = 0.1$, GH 56.0 ± 18.9 versus 68.2 ± 25.2 , $p = 0.0007$, VT 43.6 ± 21.0 versus 69.7 ± 25.4 , $p < 0.0001$, SF 63.9 ± 26.0 versus 86.9 ± 22.8 , $p < 0.0001$, RE 47.3 ± 42.1 versus 82.0 ± 35.1 , $p < 0.0001$, MH 67.6 ± 19.6 versus 82.9 ± 19.8 , $p < 0.0001$.

The pattern of changes in quality-of-life scores differed slightly for the patients with paroxysmal/persistent AF and for those with permanent AF (Table 3). In the population with paroxysmal/persistent AF, all SF-36 scores had improved at long-term follow-up except for bodily pain (Table 3). In patients with permanent AF all scores had improved, although the improvement in bodily pain and role limitation

Table 2
SF-36 scores before and 55 ± 12 months after the Maze III Operation.

SF-36 Scale	Baseline	Long-term Fu	<i>p</i>
Physical functioning	62.3 ± 23.4	81.5 ± 18.7	<0.001
Role limitation, physical	23.8 ± 36.1	76.2 ± 36.1	<0.001
Bodily pain	70.9 ± 27.1	79.1 ± 25.6	0.04
General health	56.3 ± 18.2	68.5 ± 24.3	<0.001
Vitality	43.0 ± 20.7	70.1 ± 24.0	<0.001
Social functioning	62.3 ± 26.0	87.5 ± 22.1	<0.001
Role limitation, emotional	49.6 ± 42.6	83.1 ± 34.7	<0.001
Mental health	67.3 ± 19.0	83.9 ± 19.0	<0.001

Values are mean ± SD. Fu: follow-up.

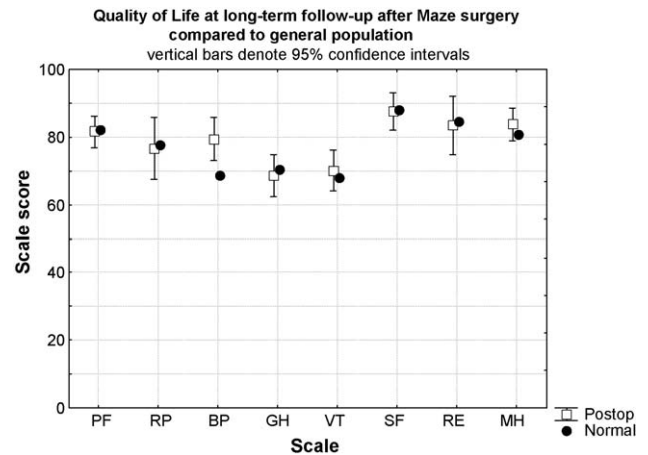


Fig. 2. Quality of life scores, assessed by SF-36, 55 ± 12 months after Maze surgery (long-term follow-up) compared to the age-matched general Swedish population. Vertical bars indicate 95% confidence intervals. PF, physical functioning; RP, role limitation owing to physical problems; BP, bodily pain; GH, general health; VT, vitality; SF, social functioning; RE, role limitation owing to emotional problems; and MH, mental health.

due to emotional problems only reached borderline significance.

4. Discussion

There are several papers reporting the effects of the Maze procedure and other surgical therapies for AF on rhythm control [1–8], but very limited data have been published regarding their effects on health-related quality of life at short or long term. In the present study, 97% of all patients had been completely free or almost free of symptomatic AF recurrences during the period to long-term follow-up, resulting in a significant improvement of health-related quality of life. At a mean of 4.6 years after Maze surgery, the health-related quality of life was similar to that of the age-matched general population. In a previous study, we found that the quality of life after the Maze procedure had improved 6 and 12 months after surgery compared to that at baseline and that the scores at 12 months were similar to those of the age-matched general population [9]. We have now demonstrated in the current study that the quality-of-life improvement is maintained 4.6 years after surgery. In this study we also compared the quality-of-life scores in the patient populations with paroxysmal/persistent AF and permanent AF, and observed similar improvement in the two groups.

In a Dutch study, quality-of-life values 4.8 years after standalone Maze surgery in 29 patients with lone AF were found to be comparable with values in the general population, but no comparison was made with quality-of-life scores before surgery [16].

There have been a number of reports on quality-of-life scores after transvenous pulmonary vein ablation for paroxysmal AF. In a prospective study of 63 patients with symptomatic paroxysmal AF, Weerasooriya reported improved quality of life, as assessed with the SF-36 questionnaire, at 3 and 12 months after pulmonary vein ablation in combination with both left and right isthmus

Table 3

SF-36 scores before and 55 ± 12 months after the Maze III Operation in different subgroups of AF patients.

SF-36 Scale	Paroxysmal/persistent AF, n = 34			Permanent AF, n = 27		
	Baseline	Long-term Fu	p	Baseline	Long-term Fu	p
Physical functioning	63.1 ± 22.1	81.9 ± 20.1	<0.001	61.5 ± 20.3	81.1 ± 17.2	<0.001
Role limitation, physical	25.0 ± 37.0	78.8 ± 37.0	<0.001	22.3 ± 35.6	73.2 ± 36.0	<0.001
Bodily pain	71.0 ± 27.3	75.5 ± 28.1	0.35	70.8 ± 27.5	83.3 ± 22.0	0.06
General health	58.2 ± 18.7	68.2 ± 27.3	0.003	53.9 ± 17.6	68.9 ± 20.7	<0.001
Vitality	46.4 ± 21.8	71.6 ± 24.2	<0.001	38.9 ± 18.8	68.2 ± 24.1	<0.001
Social functioning	56.8 ± 26.5	86.8 ± 22.8	<0.001	69.0 ± 24.1	88.4 ± 21.7	0.002
Role limitation, emotional	41.6 ± 41.5	85.4 ± 31.6	<0.001	59.2 ± 42.7	80.2 ± 38.4	0.06
Mental health	64.7 ± 21.8	84.4 ± 19.7	<0.001	70.4 ± 14.7	83.3 ± 18.5	0.001

Values are mean ± SD. Abbreviations: AF, atrial fibrillation; n, numbers of patients; Fu, follow-up.

ablation [17]. The reported success rate with a single ablation procedure was 87%. Purerfellner et al. reported quality-of-life data in 89 patients undergoing pulmonary vein ablation [18]. At baseline, the quality of life, assessed by SF-36, was lower than that of matched controls, but 6 months after ablation the scores were significantly improved and did not differ from the matched-control scores. In another study by Goldberg et al. [19], 33 patients undergoing focal radiofrequency ablation were evaluated by the SF-36 questionnaire 1 and 3 years after ablation. At both the 1- and 3-year follow-up, ablation was associated with improvement in seven out of eight quality-of-life scores but the scores were generally lower at the 3-year compared with the 1-year follow-up despite good rhythm control. The decrease was significant in the physical functioning and vitality categories.

In a study by Tse et al., cryoenergy was used in 46 patients with paroxysmal AF to isolate the pulmonary veins [20]. Freedom from AF at 3 months was achieved in 54%. No significant changes in the SF-36 scores between baseline and the 3-month follow-up were observed in any of the patients; however, in the subgroup with successful ablation, there was a significant improvement in 6 out of 8 scores compared to baseline. Improvement in quality of life seems to be correlated to rhythm control. At present, however, there are very few data on the long-term quality-of-life effects of catheter ablation for atrial fibrillation.

Despite these shortcomings, it is presently undisputable that catheter ablation is the method of choice for paroxysmal or persistent AF if pharmacological treatments fail. The success rate is reasonably high and the quality of life is improved. A growing clinical problem, however, is how to treat the patients with recurrent AF despite several attempted catheter ablations. The role for catheter ablation in permanent AF is further not clear. There are no reports on mid- or long-term success and no knowledge about quality-of-life changes.

Our study adds information that the Maze procedure has an excellent success rate, resulting in a normalised quality of life, which is maintained over long term. We believe that there still is a role for the Maze procedure as a last resort in patients with paroxysmal or persistent AF who have failed catheter ablation and possibly as a first choice in drug-resistant patients with permanent AF.

There are several limitations to our study. One is that we have no long-term recording of the cardiac rhythm at either short- or long-term follow-up. Freedom from AF is therefore based on self-reported freedom from AF symptoms in

combination with sinus rhythm at outpatient clinical visits. Another limitation is that the placebo effect of such an extensive surgical procedure is not known. However, we believe that a significant placebo effect is unlikely to persist for several years after Maze surgery.

5. Conclusions

The Cox Maze III procedure is considered to be the golden standard for surgical therapies for AF with good long-term efficacy for rhythm control. This study shows that along with excellent long-term rhythm control, improvement in health-related quality of life can be maintained over a long period in patients with symptomatic paroxysmal/persistent or permanent AF.

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