

Heart rhythm monitoring over 1 year following cardiac surgery in patients with permanent atrial fibrillation: A mono centric prospective case study

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Abstract

Background: Patients with permanent atrial fibrillation have a clearly higher risk for thromboembolic events than people with sinus rhythm. Because also anticoagulant therapy, which is the therapy of choice in chronic atrial fibrillation, has its risks, intra operative ablation therapy as a concomitant procedure has become more and more important. Nevertheless this option is not available for all patients and little is known whether the operation by itself is able to restore sinus rhythm and about the fate of these patients. Therefore we created a registry to follow the clinical course of patients with atrial fibrillation after heart surgery.

Method: All consecutive patients with permanent atrial fibrillation who were operated in our center and who were not eligible for ablation therapy were included into the registry. The patients were monitored up to postoperative month 12 with regard to their clinical outcome especially rhythm course and survival. These data were evaluated during in-hospital visits 30, 90, 180 and 360 days after operation.

Results: A total of 287 (151 male/136 female) consecutive patients with permanent atrial fibrillation were included into the registry.

During the follow-up period, approximately 10% of the patients converted to sinus rhythm. 13 patients, or 4.9%, were in stable sinus rhythm, which means that they were in sinus rhythm at every follow-up visit.

30-day mortality was 6.9% (20 of 286 patients) while it was 14.9% after one year (43 of 263 patients). Of the 13 patients who were in stable sinus rhythm after one year, only one patient died (7.7%), while of the 185 patients who were still in atrial fibrillation 43 died (23.2%).

Conclusion: Our results demonstrate that also correction of the heart disease by itself is able to restore sinus rhythm in a few patients. Nevertheless the rate of patients with continuous atrial fibrillation was approximately 90%, the rate of stable sinus rhythm, which is suspected to improve prognosis was only 4.9%. Therefore, an attempt to treat atrial fibrillation with intra operative ablation therapy is strongly justified, respecting the fact that, even if conservatively calculated, a success rate of at least 50% can be accomplished. We believe, that this applies even for endocardial and for the epicardial approach.

Introduction

Patients with atrial fibrillation exhibit a clearly higher risk for thromboembolic events [17, 18, 23]. The incidence of stroke in these patients is nearly five times higher [13], whereby atrial fibrillation may be respon-

sible for approximately 15% of all cerebral accidents [5]. As a result, both the European and American cardiology societies recommend the therapy with anticoagulants in elderly patients with structural heart disease and atrial fibrillation [6]. However, this anticoagulation treatment is problematic in elderly patients

with intellectual limited capacity without an appropriate social sphere, which in the meantime represent a large portion of patients scheduled for heart surgery [14, 20]. Overdosage poses a risk of hemorrhages [21], whereas underdosage can lead to thromboembolic complications. Additionally, even adequate anticoagulation therapy is not a guarantee of adequate protection [1].

Since only an insufficient amount of data currently exist regarding whether heart surgery alone i.e. bypass and/or valve operations leads to a spontaneous recovery of sinus rhythm, a prospective case study was performed including a sufficiently large group of patients who underwent operations without specific operative antiarrhythmic therapy with preoperative atrial fibrillation. These patients were monitored for up to 12 months postoperatively with regard to rhythm course and survival.

Methods

The question was handled by carrying out a prospective monocentric register study. Included into the register were all patients with permanent atrial fibrillation [7] that existed longer than one month prior to operation and had been confirmed by repeated surface EKGs and/or 24-hour Holter monitoring. The indication for heart surgery in these patients was based on clinical, hemodynamic or prognostic criteria.

Patients with the following findings were excluded from the register:

- Emergency operations,
- Stroke or myocardial infarction within the last three months,
- Acute myocarditis,
- Chronic heart failure (NYHA IV),
- Severe obstructive or restrictive ventilation disorders,
- Severe endocrine disorders,
- Severe kidney and/or liver function disorders,
- Pregnancy and lactation,
- Known medication and/or drug abuse,
- Paroxysmal and persistent atrial fibrillation,
- Incapacity and/or conditions that do not allow the patient to understand the nature, significance and scope of the study.

All patients got detailed instructions about the purpose and use of the register prior to the operation. After informed consent the patients were included only if

all inclusion criteria were met, if none of the exclusion criteria existed.

The study was conducted in accordance with the Declaration of Helsinki and EU guidelines [22].

All required data was recorded by a study nurse using a survey form and then entered into a database. In addition, patients were monitored over the course of one year. After their discharge from the heart center, the patients treatment was continued by their general practitioners, cardiologists or directly by the heart center for adjustments of medication and monitoring anticoagulation therapy and heart rhythm. They were re-examined after 1, 3, 6 and 12 months. A 24-hour Holter EKG was usually recorded on those occasions. The existence of a sinus rhythm was judged as a criterion of success. If a patient was in sinus rhythm at all examination appointments over a period of one year, this fulfilled the criteria for stable sinus rhythm.

The antiarrhythmic medicine was interrupted immediately before the operation, while the cardiovascular drug therapy (including thrombocyte aggregation inhibitors) was continued.

Following the operation, the patients initial received Sotalol exclusively and in the beginning of summer 2003, received metoprolol exclusively for purposes of rhythm stabilization. Phenprocoumon was used in a standardized manner for anticoagulation in instances of mechanical mitral valve replacement with a target INR of 2.5 to 3.5 and in instances of mechanical aortic valve replacement with a target INR of 2.0 to 3.0.

Sotalol/metoprolol was discontinued in all patients who were in sinus rhythm after six months and it was recommended to stop of anticoagulation. Beta-blocker therapy with metoprolol was continued in patients with structural heart disease. However, if the attending physician/cardiologist decided to continue or stop the ongoing therapeutic procedure, this decision was recorded.

Statistics

The mean and standard deviation are indicated for all continuous data and percent frequency is indicated for classified variables.

Survival probabilities and survival rates in comparison between patients with and without sinus rhythm were described by means of Kaplan-Meier curves and calculated by means of a log rank test. Probabilities smaller than 0.05 were evaluated as significant.

Operative data (duration; type: bypass, aortic valve, mitral valve), accompanying illnesses (stroke, myocardial infarction, rheumatic illnesses, diabetes mellitus, arterial hypertension, pulmonary hypertension) and factors that may possibly influence the clinical outcome of the operation (diameter of the left atrium, left ventricular ejection fraction, duration of the preoperative atrial fibrillation) were taken into consideration as variables for a confounder analysis. The analysis itself was conducted as a multivariate regression analysis.

Results

Study population

Over the span of three years, a total of 287 consecutive patients with permanent atrial fibrillation were included. 151 of the patients were male, 136 were female. The mean age of the patients was 71.3 ± 6.4 years, average height was 168 ± 10 centimeters, and mean weight was 75 ± 14.2 kg. All patients showed permanent atrial fibrillation, on average for 5.1 ± 7.8 years. Left ventricular ejection fraction equalled $52.1 \pm 13.9\%$ and the diameter of the left atrium in the parasternal acoustic window of the echocardiography was 50.9 ± 9.3 millimeters. Demographic and clinical data are summarized in Table 1.

There were myocardial infarction and stroke in the medical histories of 62 and 39 patients, respectively. 122 patients had diabetes mellitus, 222 arterial hypertension, 159 pulmonary hypertension, 169 hyperlipidemia and 94 hyperuricemia. Eleven patients were smokers at the time of the operation, and 74 had ceased smoking. 172 patients were obese. Table 2 shows the operations that were conducted.

An isolated operation was conducted in 164 cases. Combined interventions were performed on 123 patients (93 patients underwent a double combined operations, 21 patients underwent a triple combined operations, six patients underwent a quadruple combined operations, two patients underwent fivefold combined operations and one patient underwent sixfold combined operations). The mean duration of the operation was 2.85 ± 1.0 hours (range: 1.3 - 7.95 hours).

Table 1: Patient demographic and clinical data

No. of patients:	287	
Male/female	151/136	
Age [years]	71.3 ± 6.4	Range: 36 - 88
LVEF [%]	52.2 ± 13.9	Range: 20 - 85
Duration of pAF [years]	5.1 ± 7.8	Range: 0.2 - 37.2
LA [mm]	50.9 ± 9.03	Range: 24 - 99
BMI [Kg/m ²]	26.6 ± 4.1	Range: 16.7 - 42.5

BMI: body mass index; LVEF: left ventricular ejection fraction; pAF: permanent atrial fibrillation; LA: left atrium diameter – parasternal

Table 2: Types of heart surgery conducted

ACB	148	51.6%
AVRp	112	39.0%
MVRp	71	24.7%
MVRe	29	10.1%
TCRe	24	8.4%
other	54	18.8%

ACB: aortocoronary bypass; AVRp: aortic valve replacement; MVRp: mitral valve replacement; MVRe: mitral valve reconstruction; TCRe: tricuspid valve reconstruction; multiple categories possible

Rhythm course

The main attention was focused on the postoperative rhythm course, i.e. recovery of sinus rhythm without ablation treatment. Table 3 shows the number of patients in sinus rhythm at day 30, 90, 180 and 360 “follow-up.” Rhythm data could not be obtained during the follow-up period approximately 8% of the patients.

Approximately 10% of the patients were in sinus rhythm at one or more of the follow-up appointments. 13 patients, or 4.9%, were in stable sinus rhythm (those patients who exhibited a sinus rhythm at each examination). Therefore, the remaining 5.1% of patients exhibited paroxysmal atrial fibrillation over the first year after the operation.

A total of 47 patients had a pacemaker after one year (VVI: 42 patients, DDD: 5 patients). Since 29 patients already had pacemakers prior to the operation (10.1%), the rate of new implants was 6.2%. Five cardioversions were performed during the stay at the heart center. Nine further electric cardioversions were

Table 3: Rhythm course of the patients of the control group after 30, 90, 180 and 360 days

	Postoperative day			
	30	90	180	360
no. of patients (n = 287)	266	233	223	219
deceased	20	29	39	43
absent	1	25	25	25
sinus rhythm	22	20	21	23
atrial fibrillation	239	209	197	188
atrial flutter				
– typical	3	1	2	5
– atypical	0	0	0	0
cumulative VVI-SM	32	26	21	24
cumulative DDD-SM	1	2	3	3
no. of CV	9	1	0	1
spontaneous sinus rhythm	9.0%	9.5%	9.5%	11.5%

VVI-SM: Single chamber pacemaker; DDD-SM: dual chamber pacemaker; CV: electric cardioversion

performed in the ensuing rehabilitation, all these patients remained in sinus rhythm for only a short period of time.

The vast majority of patients exhibited atrial fibrillation within the first 10 days following the operation. A few patients, however, were in sinus rhythm during the immediate post operative period but then later exhibited atrial fibrillation once again. Figure 1 shows the time of the first recorded atrial fibrillation following early postoperative atrial or av-sequential stimulation as an expression of the loss of the sinus rhythm or the inability to continue atrial stimulation.

Mortality

Figure 2 shows cumulative survival of the patients over time. After 30 days, mortality was 6.99% (20 of 286 patients) and 14.98% after one year (43 of 263 patients).

Of the 13 patients who were in stable sinus rhythm after one year, no patient died (0%), while from the 185 patients who continued to exhibit atrial fibrillation after the operation, 43 died (23.2%). Statistical analysis by means of rank tests cannot be performed be-

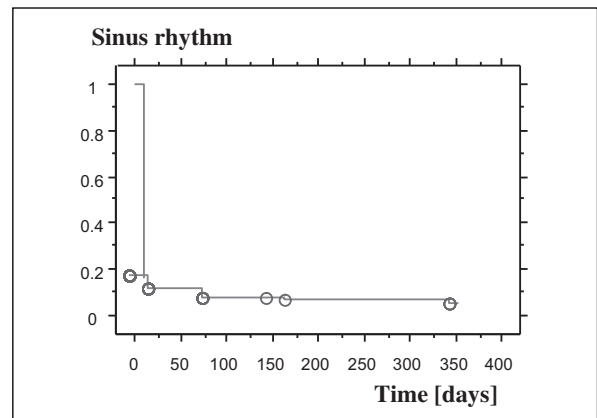


Figure 1. Time of the first recorded postoperative atrial fibrillation (Kaplan-Meier analysis)

cause no events occurred in the “stable sinus rhythm” group.

Preoperative factors influencing mortality

A further analysis investigated which factors influenced postoperative mortality after the operation. Pre-

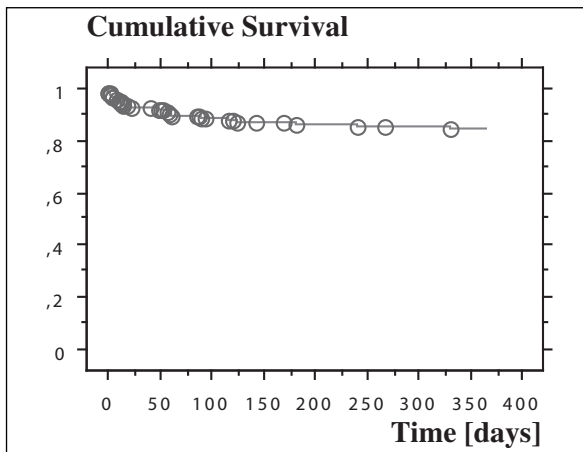


Figure 2. Cumulative survival for patients up to one year after the operation (Kaplan-Meier analysis)

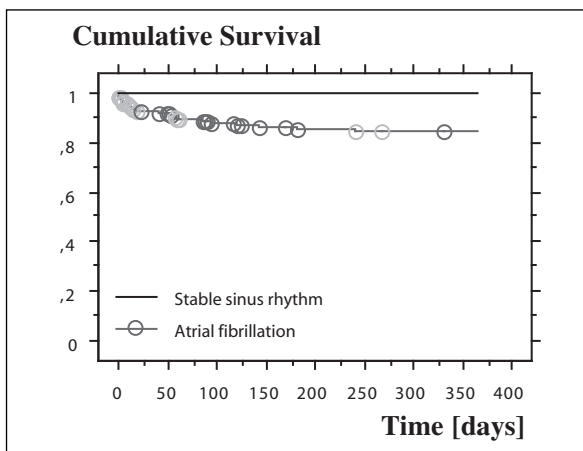


Figure 3. Cumulative survival of those patients who remained in stable sinus rhythm or in atrial fibrillation up to one year (Kaplan-Meier analysis)

operative parameters such as size of the atrium, duration of atrial fibrillation prior to the operation, ejection fraction and patient age, as well as cardiovascular risk factors such as diabetes mellitus, arterial hypertension, obesity and smoking were classified as factors of influence. Further accompanying illnesses such as pulmonary hypertension, as well as intraoperative factors such as the operation duration (indicating the complexity of the intervention), conducting a coronary bypass, an aortic valve operation and a mitral valve operation, were taken into consideration. Significant factors influencing mortality (within the scope of a covariable analysis of the Kaplan-Meier statistics) were found to be:

- Duration of the operation ($p < 0.0001$),
- Prior stroke ($p = 0.0016$)
- Ejection fraction ($p = 0.0034$), and
- Age ($p = 0.0246$) of the patient.

The duration of the operation of the surviving patients was shorter (2.7 ± 0.8 hours) than of those patients who died later on (3.7 ± 1.6 hours).

Of the 287 patients in the entire group, 39 (14%) had already experienced a stroke. Eleven of these incidents occurred in the deceased patients (26%), and 28 occurred in the surviving patients (12%).

The surviving patients were a little bit younger than those who died with ages of 70.9 ± 8.3 years and 72.3 ± 8.1 years, respectively, and exhibited a somewhat higher left ventricular ejection fraction of $52.9 \pm 13.4\%$ (in comparison to $47.0 \pm 15\%$ for the deceased patient group). The remaining factors did not influence postoperative survival.

Discussion

In general, it can be assumed that the vast majority of patients suffering from atrial fibrillation preoperatively will continue to experience atrial in other studies fibrillation following heart surgery [2, 8, 9, 12, 24]. In other studies after one year, between 0% [3] and 31.5% [19] of patients were in sinus rhythm. This is a considerable degree of variability that may in fact be mainly due to the small number of cases in these studies. To date, however, there have been no prospective surveys (if one disregards the small control groups of the randomized ablation studies).

As a result, a prospective case register for patients with permanent atrial fibrillation was established in Dresden in order to record and analyze the frequency of sinus rhythm following single heart operations.

The criterion of success at the follow-up of patients who received ablation treatment is differently defined in the various studies. While in some studies the presence of sinus rhythm at the time of the follow-up was considered to be a criterion of success, it was the absence of atrial fibrillation in others. For sure it is difficult to detect a permanent sinus rhythm because not all patients notice the onset of atrial fibrillation. Continuous rhythm monitoring is also not possible (with the exception of patients who have the option of home monitoring). As a compromise, the present survey proceeded in such a way that sinus rhythm was judged as stable if a patient exhibited sinus rhythm on a surface

or 24-hour Holter EKG at all follow-up appointments. These data can only be ascertained when patients are repeatedly asked to return to the hospital during the postoperative period or are closely monitored within the context of a structured collaboration with the cardiologists who are continuing the patient's care.

The results show that for patients who exhibit permanent atrial fibrillation prior to operation, stable sinus rhythms occurred only in very limited number of cases after the operation. Approximately 10% of the patients were in sinus rhythm at one of the follow-up appointment, while only 4.9% exhibited a stable sinus rhythm lasting over the one year period.

In our study, stable sinus rhythms in the postoperative period were observed more frequently in younger patients, with shorter operation time, with good ejection fractions and with patients who had not already suffered a stroke. In particular, age as well as the ejection fraction could be identified as factors for postoperative restoration of sinus rhythm [6].

The mortality rate of 14.9% after one year is comparable to the results reported in other studies ranging from 8 to 19% [4]. In addition, there was a clear advantage for survival for patients who achieved a stable sinus rhythm after the operation [11]. A similar result was reported by Obadia, who likewise found an advantage for survival in patients who were in sinus rhythm following the operation, remarkably whom the difference over time – up to four years – became clearer (15%). 92% of the patients in sinus rhythm were still alive after four years, whereas only 77% of those with atrial fibrillation survived [16].

Conclusion

Knowing the incidence of restoration of sinus rhythm following heart surgery in patients who suffer from permanent atrial fibrillation prior to the operation is absolutely necessary for evaluating the efficacy of ablation treatment. Regarding this topic, we find essentially retrospective analyses [2, 8, 9, 14, 22], smaller prospective surveys [6, 15] or control groups from randomized studies [3, 18] – which nevertheless also have only very small numbers of cases – in the literature.

Our results show that approximately 10% of patients with preoperative permanent atrial fibrillation have sinus rhythm at one are more postoperative monitoring appointments and only 5% achieved a permanent sinus rhythm (the other 5% showed paroxysmal atrial fibrillation).

Conservatively estimated, a stable sinus rhythm can be achieved postoperatively with comparable operations including ablation treatment in at least every second patients. Therefore, this investigation supports the strategy of concomitant ablation therapy during heart surgery in patients with atrial fibrillation.

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