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Quality of life and costs of conventional therapy in patients treated by catheter ablation for atrial fibrillation

Veronika Bulková[a,b], Martin Fiala[c], Dan Wichterle[a], Luděk Haman[d], Jan Chovančík[c], Štěpán Havránek[a], Jiří Duda[d], Jakub Pindor[c], Miroslav Novák[b], Petr Pařízek[d]

[a] *II. interní klinika kardiologie a angiologie, 1. lékařská fakulta Univerzity Karlovy a Všeobecná fakultní nemocnice, Praha, Česká republika*
[b] *International Clinical Research Center – I. interní kardioangiologická klinika, Lékařská fakulta Masarykovy univerzity a Fakultní nemocnice u sv. Anny v Brně, Brno, Česká republika*
[c] *Oddělení kardiologie, Kardiocentrum, Nemocnice Podlesí, a. s., Třinec, Česká republika*
[d] *I. interní kardioangiologická klinika, Lékařská fakulta Univerzity Karlovy v Hradci Králové a Fakultní nemocnice Hradec Králové, Hradec Králové, Česká republika*

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SUMMARY

Aims: The purpose of the study was to assess quality of life, socioeconomic parameters, and costs of conventional therapy in patients treated by catheter ablation for atrial fibrillation (AF).
Methods: The study included 160 patients treated by catheter ablation for AF who fulfilled a minimum of 2-year follow-up. Quality of life using EQ-5D questionnaire, and days of hospitalization and working incapacity were evaluated before ablation and every 6 months after ablation. Further, one-year costs of conventional therapy for AF were assessed before and after ablation.
Results: Quality of life was significantly improved at each post-ablation stage. EQ-5D index increased from baseline 68 ± 14 to 76 ± 17 after 2 years ($p < 0.001$), and EQ-VAS score from baseline 65 ± 17 to 71 ± 15 after 2 years ($p = 0.01$). Significant reduction was further observed in the count of hospitalization days and days of working incapacity (both $p < 0.01$). The cost of conventional therapy per patient per year decreased from 49,337 Czech crowns (1974 €) before ablation to 16,504 CZC (660 €) and 13,576 CZC (543 €) in the first and second post-ablation year, respectively.
Conclusion: AF ablation was associated with significant improvement in quality of life, and decrease in days of hospitalization and working incapacity. There was more than three-fold reduction in the costs of conventional therapy observed in the first two years after ablation.

SOUHRN

Cíl: Cílem práce bylo zhodnocení kvality života, socioekonomických parametrů a výdajů na konvenční terapii u pacientů léčených katetrovou ablací pro fibrilaci síní (FS).
Metodika: Do studie bylo zařazeno 160 pacientů léčených katetrizační ablací pro FS, kteří byli následně sledováni minimálně po dobu dvou let. Kvalita života se hodnotila dotazníkem EQ-5D a počet dnů hospitalizace a pracovní neschopnosti se zjišťoval před ablací a každých šest měsíců po ablaci. Dále se stanovovaly jednoroční výdaje na konvenční léčbu před ablací a po ablaci.

Adresa: Mgr. Veronika Bulková, Ph.D., II. interní klinika kardiologie a angiologie, 1. lékařská fakulta Univerzity Karlovy a Všeobecná fakultní nemocnice, U Nemocnice 2, 128 08 Praha 2, e-mail: veronika.bulkova@gmail.com
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Klíčová slova:
Fibrilace síní
Katetrizační ablace
Konvenční léčba
Kvalita života
Náklady na léčbu

Výsledky: Kvalita života se po ablaci významně zlepšila v každém stadiu studie. Index EQ-5D se zvýšil z výchozích 68 ± 14 na 76 ± 17 po dvou letech ($p < 0,001$), a skóre EQ-VAS se zlepšilo z výchozích 65 ± 17 na 71 ± 15 po dvou letech ($p = 0,01$). Dále došlo k významné redukci v počtu dnů hospitalizace a pracovní neschopnosti (obě $p < 0,01$). Cena konvenční léčby/pacienta/rok klesla ze 49 337 Kč před ablací na 16 504 Kč, respektive 13 576 Kč v prvním a druhém roce po ablaci.
Závěr: Ablace FS byla spojena s významným zlepšením kvality života a poklesem dnů hospitalizace a pracovní neschopnosti. Náklady na pokračující konvenční léčbu poklesly po ablaci více než trojnásobně.

Introduction

Quality of life (QoL) and costs of medical and social care represent, in addition to mortality, the fundamental criteria of efficacy and cost-efficacy of a therapeutic method. Their significance becomes even more prominent in active population without serious comorbidities. Prevalence of atrial fibrillation (AF) grows and costs of therapy of this condition have been steadily growing [1,2]. In addition to the increasing direct medical costs spent on treatment of AF and its complications, expenses on working incapacity, lost profits, invalidity, and social benefits also need to be taken into consideration.

This study sought to evaluate quality of life and socioeconomic parameters in patients undergoing AF ablation. It further assessed costs of conventional therapy one year before ablation and two years after ablation.

Methods

Patients

The study included 160 consecutive patients aged ≥ 18 years who underwent their first catheter ablation for symptomatic AF in the year 2007 in two centers, and who were subsequently prospectively followed-up for 2 years.

Data collection

Demographic, medical, social, and socioeconomic data obtained from the patients' history and examinations during the index hospitalization and subsequent outpatient visits was analyzed. This data was recorded into a questionnaire and stored on an internet portal under the personal patient's code.

Assessment of quality of life and socioeconomic parameters

QoL was assessed by the European Quality of Life Group instrument – EQ-5D self report questionnaire. This standardized questionnaire consists of 2 parts – EQ-VAS (visual analogue scale of 0 to 100 for recording individuals' rating of their current health-related QoL state), and the 3-level, 5-dimensional descriptive system (EQ-5D), which evaluates mobility, self-care, usual activities, pain/discomfort and anxiety/depression on a 0 to 100 scale using the European value set [3]. Patients filled out the questionnaire on their own without any assistance from medical staff before, and every six months after the ablation, when the questionnaires were sent to them home by post. Counts of days of hospitalization and working capacity per patient per six months were assessed before ablation and for each 6-month post-ablation period. All patients completed 24-month follow-up.

Assessment of costs of conventional therapy

Yearly costs of conventional therapy per patient one year before ablation and two years after ablation were evaluated. At the same time, costs of ablation therapy were ascertained. Repeat ablation was performed by the end of the follow-up period in 57 (36%) patients; 7 (4%) patients underwent two repeat ablation procedures. Thus, in total, 64 repeat ablation procedures were calculated.

The count of outpatient visits was averaged for each follow-up period. The expenses on days spent in working incapacity were calculated from mean salary in the Czech Republic which was 22,748 Czech crowns (CZC) (910 €). The costs of the hospitalizations were calculated from the daily rate applied by the Czech General Health Insurance Company. Costs of drugs were obtained from their mean price, costs of laboratory and diagnostic tests were determined from the price list of the Czech General Health Insurance Company. The costs of diagnostic/therapeutic procedures were calculated from the count of procedures per one patient per one year in relation to the point rating of a particular procedure. The remaining health care costs were calculated from the current rating of the Czech General Health Insurance Company.

Statistical analysis

Data from the questionnaires was edited in the Microsoft Excel version 9.0.2812 program. All analyses were performed using the Statistica version 6.1 software (Statsoft, Inc., Tulsa, OK, USA).

Continuous variables were expressed as mean ± standard deviation and compared by the 2-tailed Student's t-test. Categorical variables were expressed as percentages and compared by χ^2-test. A p-value < 0.05 was considered significant.

Results

Mortality and questionnaire recoverability

During the follow-up, 2 (1%) patients died 12 and 20 months after ablation, respectively. Hemorrhagic stroke was the cause of death in both patients who continued to use warfarin. Questionnaire was recovered from 125 (78%), 110 (69%), 136 (85%), and 122 (76%) patients after 6, 12, 18 a 24 months, respectively.

Baseline characteristics

Baseline characteristics are listed in Table 1. Palpitations, sweating, fatigue, and incapacity dominated the symptoms (Table 2). Baseline medication is shown in Table 3.

Table 1 – Baseline characteristics.	
Females	41 (26%)
Age (years)	58 ± 10
Working	93 (58%)
Retired	13 (8%)
Invalids	54 (34%)
Body mass index	28,8 ± 4,3
AF duration (months)	57 ± 52
AF paroxysmal	89 (56%)
AF persistent	15 (9%)
FS long-standing persistent	56 (35%)
SBP baseline (mmHg)	132 ± 18
DBP baseline (mmHg)	83 ± 11
HR baseline (bpm)	81 ± 20
Hypertension	81 (51%)
Diabetes mellitus	20 (13%)
Hyperthyreoidism	11 (7%)
Hypothyreoidism	16 (10%)
Stroke/TIA	13 (8%)
Dilated cardiomyopathy	13 (8%)
History of myocarditis	3 (2%)
History of pericarditis	1 (0.6%)
Mitral valve disease	14 (9%)
CAD	13 (8%)
History of heart surgery	5 (3%)
History of PCI	4 (2%)
Bronchopulmonary disease	11 (7%)
Pacemaker	3 (2%)

CAD – coronary artery disease; DBP – diastolic blood pressure; HR – heart rate; PCI – percutaneous coronary intervention; SBP – systolic blood pressure; TIA – transitory ischemic attack.

Table 2 – Symptoms.	
Palpitations	131 (82%)
Sweating	50 (31%)
Fatigue	58 (36%)
Incapacity	100 (62%)
Chest oppression	28 (17%)
Dyspnea	78 (48%)
Presyncope	24 (15%)
Syncope	10 (6%)

Table 3 – Baseline medication.	
Propafenone	36 (23%)
Sotalol	20 (13%)
Amiodarone	56 (35%)
Beta-blocker	78 (48%)
Digoxin	7 (4%)
ACE-I	52 (32%)
ARB	12 (7%)
Diuretics	42 (26%)
ASA	3 (2%)
Statin	32 (20%)
Warfarin	154 (96%)

ACE-I – angiotensin-converting enzyme blocker; ARB – angiotensin II receptor blocker; ASA – acetylsalicylic acid.

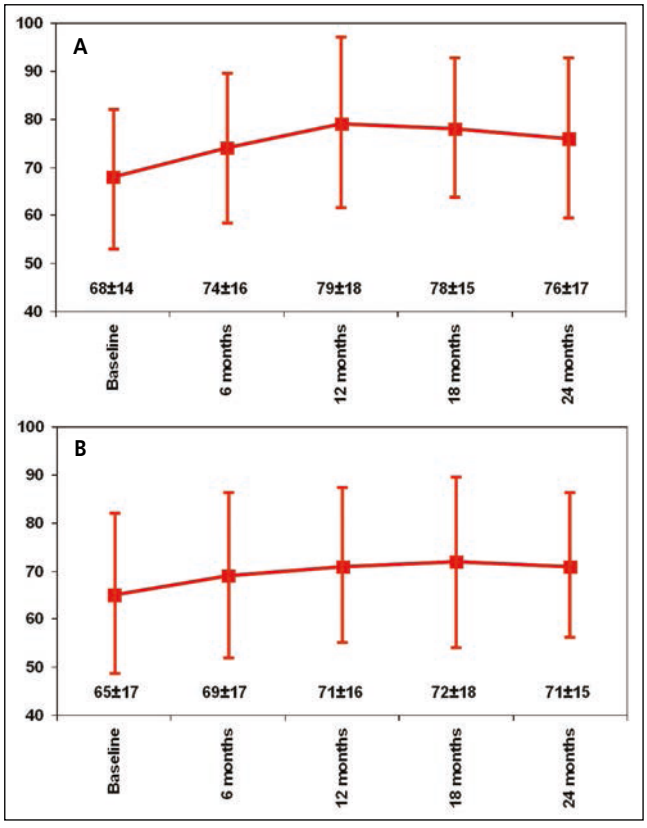

Fig. 1 – Panels A and B show evolution of EQ-5D index and EQ-VAS score of quality of life on a 0–100 scale before ablation and at the 6-, 12-, 18-, and 24-month post-ablation stages as assessed by EQ-5D questionnaire. Improvements in both portions became significant after six months and remained significant after two years (*p*-values in the text).

Ablation procedure characteristics

Procedure time (304 ± 77 min), fluoroscopy time (34 ± 31 min), and radiofrequency application time (89 ± 52 min) reflected participation of operators with different experience and inclusion of patients with persistent AF requiring more complex ablation strategy. Occurrence of 3 serious complications in 3 (2%) patients, namely cardiac tamponade in two (1.3%) patients, and transient ischemic attack in one (0.6%) patient did not differ from the results of worldwide registries [4,5].

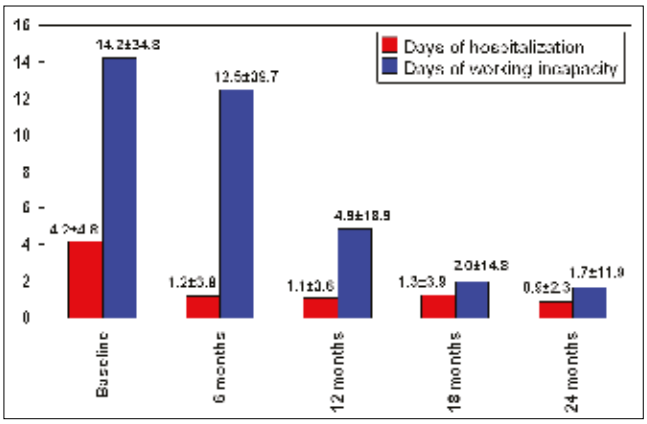

Fig. 2 – The figure shows number of days of hospitalization and number of days of working incapacity per one patient per 6 months before ablation and in the 2-year post-ablation period. Reductions in the number of days of hospitalization and working incapacity became significant after 6 and 12 months, respectively (*p*-values in the text).

Quality of life – questionnaire EQ-5D

EQ-5D index of quality of life improved already after 6 months ($p = 0.02$), and the improvement persisted at all the follow-up stages (all $p < 0.001$). EQ-VAS score of quality of life increased significantly after 12 months ($p = 0.02$), and its amelioration also persisted after 18 and 24 months, respectively ($p < 0.01$, and $p = 0.01$, respectively) (Fig. 1).

Socioeconomic parameters

Pre-ablation count of hospitalization days/one patient/six months was 4.2 days, and decreased to 1.3 days 6 months after ablation ($p = 0.01$), and to 1.1, 1.0, and 0.9 days, respectively after 12, 18, and 24 months, respectively (all $p < 0.01$) (Fig. 2) .

Pre-ablation count to days of working incapacity/one patient/six months amounted to 14.2, and decreased insignificantly after six months to 12.5 days, however, subsequently dropped significantly to 4.9 days after 12 months ($p = 0.02$), and to 2.0 and 1.7 days, respectively, after 18 a 24 months (both $p < 0.01$) (Fig. 2).

Costs of conventional therapy

The mean cost of ablation procedures per one patient including repeat ablations was 259,000 CZC (10,360 €). The costs of conventional therapy per one patient per one year summed up to 49,337 CZC (1,974 €) before ablation, while they were reduced to 16,504 CZC (660 €) in the first post-ablation year and to 13,576 CZC (543 €) in the second post-ablation year (Table 4).

Discussion

This study analyzed quality of life, socioeconomic parameters, and costs of conventional therapy in patients undergoing catheter ablation for AF. The main findings

Table 4 – Cost of conventional therapy for AF.

	Cost of 1 item (CZC)			N. items/1 pt/1 year			Cost/1 pt/1 year		
Procedure	1 year pre-ablation	1st year post-ablation	2nd year post-ablation	1 year pre-ablation	1st year post-ablation	2nd year post-ablation	1 year pre-ablation	1st year post-ablation	2nd year post-ablation
Examination by cardiologist	304	304	304	5.2	5.4	4.6	1,581	1,642	1,398
AAD and AC	3,726	3,726	3,726				3,726	3,726	3,726
Hospitalization for AF	5,481	5,481	5,481	4.2	1.1	0.91	23,020	6,029	4,987
No days of working incapacity	454.9	454.9	454.9	14.2	4.9	1.7	6,460	2,229	772
Electrical cardioversion	1,080	1,080	1,080	1.4	0.25	0.16	1,512	367	173
Stroke therapy	4,048			0.08			324		
Negative SCA	44,375			0.19			8,431		
Pacemaker	88,600			0.02			1,772		
Examination by practitioner							725	725	725
Stomatology							829	829	829
Transportation							126	126	126
Rescue service							89	89	89
Health affliction voucher							410	410	410
Spa, sanatoria							332	332	332
Total/1 patient							49,337	16,504	13,567

AAD – antiarrhythmic drug; AC – anticoagulation; PM – pacemaker; pt – patient; SCA – selective coronary angiography.

of the study are as follows: 1) quality of life assessed by the questionnaire EQ-5D improved significantly in both its portions at all follow-up stages; 2) ablation was associated with a significant decrease in hospitalization days and days of working incapacity; 3) more than three-fold reduction in the cost of conventional therapy was observed in the first two years after ablation.

Quality of life and socioeconomic parameters

This study corroborated prior observations of significant improvement of QoL in patients after catheter ablation of AF [6–9]. Recent studies similarly to our study demonstrated that the improvement of quality of life persisted long term [10,11]. In addition, the counts of days of hospitalization and working incapacity were significantly reduced. The greatest benefit was achieved after one year and later when AF/atrial tachycardia recurrences disappeared either spontaneously (in case of early temporary arrhythmia), or after successful repeat ablation. Specifically, a decrease in days of working incapacity was only insignificant after six months, while a 7–8 fold reduction was observed after 18 and 24 months.

Cost of conventional therapy

Earlier analysis in patients with AF treated by private internists/cardiologists in the Czech Republic and not undergoing catheter ablation demonstrated 1-year costs of conventional AF therapy per one patient to amount to 42,407 CZC (1,697 €) [12]. The Czech costs of conventional AF therapy were approximately half the common costs in western European countries possibly as a result of lower labor costs [13,14]. In this study, expenses on AF treatment in patients undergoing catheter ablation were assessed, and by reaching 49,337 CZC (1,974 €) per a patient per a year exceeded the expenses found in the above mentioned population (12) by nearly 7,000 CZC (280 €). It can be speculated that patients undergoing ablation are likely to be more symptomatic and require more pharmacologic and other interventions. Considering the costs of all ablation procedures per one patient of 259,000 CZC (10,360 €), and considering the costs of continuing conventional therapy of 16,504 CZC (660 €) in the first post-ablation year and 13,576 CZC (543 €) in the second post-ablation year, respectively, and estimating similar costs of conventional therapy during the following years, the costs of ablation therapy should be paid back within 7–8 years.

This simple arithmetic calculation, however, does not reflect more complex health and social care issues. First, progression of complications of AF and use of more expensive drugs may escalate the costs of conventional therapy in patients who do not undergo timely ablation. Arrhythmia-induced cardiomyopathy, which is reversible after successful ablation [15,16], often kindles a chain of wrong diagnostic and curative steps (repeat negative coronary angiographies, primary preventive ICD implantation, etc.) without hope in cure, however, with immense subsequent expenses on compromise therapeutic strategies (heart failure therapy, ICD reimplantations, etc.). Medical treatment with angiotensin-converting enzyme inhibitors or angiotensin II receptor blockers that have become routine in AF therapy also represents not a trivial expense. In addition, for example, considering the cost of an average 5 mg daily warfarin dose of 2.12 CZC (0.08 €) a day, and the cost of dabigatran 150 mg bid of 71.7 CZC (2.8 €) (note: current price of 100 tablets of warfarin 5 mg is 212 CZC [8.5 €], and the price of 60 capsules of dabigatran 150 mg remains 2,150 CZC [86 €]), the changeover from warfarin to dabigatran would increase the cost of one-year anticoagulation from 774 (31 €) to 26,171 CZC (1,047 €). This would project onto yearly rise in costs of conventional therapy from 49,337 (1,974 €) to 74,734 CZC (2,990 €). Further e.g., costs of catheter ablation for type I atrial flutter at the time, when AF already occurred simultaneously and might have been eliminated by the same ablation procedure, were not also involved in the analysis.

On the other hand, the first two years after ablation represent a period of possible repeat ablation procedures and relatively intensive outpatient care, while full clinical and economic benefit is achieved only later. Therefore, it is possible that the costs of continuing conventional therapy in the subsequent post-ablation years are lower, and AF ablation becomes cost-effective earlier.

Finally, this study did not calculate savings resulting from recovered health and working capacity, or, on the contrary, expenditures on further disease progression, continuing working incapacity and invalidity. Importantly, AF ablation immensely impacts an otherwise healthy population of an average age of 55 to 60 years. With regard to this issue, this study group included 8% of invalid patients in whom AF itself was the dominant cause of invalidity. AF ablation, in stark contrast to other expensive cardiology disciplines, treats mainly active and productive patients, in whom the expenses on ablation will often be paid back still in their productive age. Absolute values of quality of life indicate that these patients return into the state of full health and productivity. Therefore the global economic profit from successful ablation is possibly achieved much earlier than can be calculated from direct costs of medical care. More reliable calculation of cost-efficacy in relation to social expenditures would, however, need more complex mathematical models [17].

Limitations

Because the follow-up questionnaires were mailed to the patients' home, and because the patients responded voluntarily, the data evaluation was limited only to the responders. However, the questionnaire recovery between 66% and 84% at different stages of the study was favorable when compared with similar questionnaire projects. Furthermore, this study practice ensured independence of the responding patients who were not influenced or even biased by the medical staff assistance.

Conclusions

Catheter ablation of AF significantly improved QoL and reduced hospital admissions and working incapacity at all stages of the 2-year follow-up. In addition, more than three-fold reduction in the costs of conventional therapy was achieved in the first two years after ablation.

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