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CLINICAL EFFECTS OF RADIOFREQUENCY ABLATION OF PULMONARY VEINS OSTIA IN ATRIAL FIBRILLATION (COMPARISON WITH ANTIARRHYTHMIC THERAPY)

GUREVICH M.A.

Department of Internal Diseases, Moscow Regional Research and Clinical Institute ("MONIKI") after M.F. Vladimirski, Moscow, Russia

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ABSTRACT

Atrial fibrillation is one of the most common heart rhythm disorders in patients with cardiovascular diseases. The prevalence of atrial fibrillation increases 2 times from 0.5% in patients younger than 60 years to 9% in individuals older than 80 years with each decade of age.

Among the reasons of atrial fibrillation recurrences the following states should be taken into account: valvular heart disease (more often sclerotic malformations, less often rheumatic ones), chronic heart failure, arterial hypertension, adiposis, diabetes, myocarditis and cardiomyopathy and etc. During ischemic heart disease atrial fibrillation rate increases five times.

Dilation of left atrium, structural changes and remodeling including aseptic inflammation and oxidative stress, apoptosis and hypertrophy of cardiomyocytes, formation of connective tissue, fibrosis occur during atrial fibrillation.

The indications for antiarrhythmic therapy and radiofrequency ablation of left atrium are described in present study. Positive and negative effects of atrial fibrillation treatment methods are presented. Recurrences of atrial fibrillation now represent one of the main challenges in the treatment of this arrhythmia and clinically correct therapeutic approach plays the important role in further rhythm control.

The presentation of different methods approach in various clinical states of atrial fibrillation is discussed. Clinical and advanced evaluation of patients is important in decision making for treatment approach. Radiofrequency ablation approach has several advantages for rhythm control over pharmacotherapy in patients with preserved cardiac structure and function. Advantages of radiofrequency ablation during persistent atrial fibrillation and atrial flutter are shown. The choice of atrial fibrillation therapy strategy is defined depending on the character of arrhythmia, severity of clinical symptoms, presence of comorbidities, individual tolerance of various groups of antiarrhythmic drugs, medical experience and patient preference. Positive combination treatment effect of both methods of atrial fibrillation in various stages of arrhythmia is presented.

KEYWORDS: *radiofrequency ablation, antiarrhythmic therapy, atrial fibrillation, amiodarone, propafenone, complications.*

INTRODUCTION

Atrial fibrillation is one of the most common heart rhythm disorders in patients with cardiovascular diseases. The prevalence of atrial fibrillation increases 2 times from 0.5% in patients younger than 60 years to 9% in individuals older than 80 years with each decade of age [*Lloyd-Jones D et al., 2004*].

Among the reasons of atrial fibrillation recurrences the following states should be taken into account: valvular heart disease (more often sclerotic malformations, less often rheumatic ones), chronic heart failure, arterial hypertension, obesity, diabetes, myocarditis and cardiomyopathy

ADDRESS FOR CORRESPONDENCE:
Department of Internal Diseases
61/2 Schepkin Street, Moscow 129110, Russia
Tel.: (+7 495 681 3509)
E-mail: magurevich@mail.ru

and etc. [*Nabauer M et al., 2009; Pillarisetti J, Lakkireddy D, 2014*]. In ischemic heart disease atrial fibrillation rate increases five times.

Dilation of left atrium, structural changes and remodeling including aseptic inflammation and oxidative stress, apoptosis and hypertrophy of cardiomyocytes, formation of connective tissue, fibrosis may occur in atrial fibrillation.

The main purposes of therapy of patients with atrial fibrillation are the reduction of symptom load, hemodynamic disorders, prevention of cardiovascular complications, improvement of prognosis and life quality of patients.

There are 2 strategies of patients' treatment: "control of ventricular contraction rate" on the background of persistent atrial fibrillation and "control of sinus rhythm" in consequence of paroxysms' cupping and its further maintenance.

The choice of atrial fibrillation therapy strategy is defined depending on the character of arrhythmia, severity of clinical symptoms, presence of comorbidities, individual tolerance of various groups to antiarrhythmic drugs, medical experience and patient preference.

The opinion that both strategies "control of sinus rhythm" and "control of ventricular contraction rate" are prophylactically equivalent using antiarrhythmic drugs in the therapy of patients with atrial fibrillation because of the absence of significant differences of disease outcome, progression of heart failure, rehospitalization, fatal outcomes of cardiovascular diseases and other reasons is more proved at present.

In clinical practice frequently we observe less effective antiarrhythmic drug therapy for sinus rhythm control in patients with paroxysmal and persistent forms of atrial fibrillation. β-adrenergic or nondihydropyridine calcium antagonists (verapamil, diltiazem) usually serve for ventricular contraction rate control. Electrical cardioversion, application of antiarrhythmic drugs and invasive intervention are applied more often during the strategy of "sinus rhythm control".

Following medications are recommended as the strategy of "sinus rhythm control" according to guidelines of Russian and American Cardiology and Arrhythmologic Societies: amiodarone, propafenone, sotalol, flecainide, etacisin, allapinin, etmozin. Amiodarone is the only medication applied aimimg for secondary prophylaxis of atrial fibrillation in patients with heart failure.

Propafenone prevents the recurrences of atrial fibrillation and is harmless in patients without structural heart diseases.

The method of radiofrequency ablation may be applicated for atients with paroxysmal and persistent form of atrial fibrillation as an alternative or in combination with antiarrhythmic therapy.

Pulmonary veins play a significant role in the formation of atrial tachyarrhythmia. The ablation of areas with predominance of high frequency of impulses more often located in the sphere of connection of pulmonary veins with left atrium results in the elongation of atrial fibrillation cycle and the recovery of sinus rhythm. The procedure of radiofrequency ablation more often includes *pulmonary vein* isolation with the application of radiofrequency interactions [*Sulimov V et al., 2013*].

Numerous randomized studies were performed where the efficacy of radiofrequency ablation and antiarrhythmic therapy was compared in patients with paroxysmal and persistent form of atrial fibrillation [*January C et al., 2014*]. The effectiveness of radiofrequency ablation in the prevention of atrial fibrillation recurrences formation was varied in various studies from 40% to 90% throughout the first year after the ablation depending on the character of atrial fibrillation. radiofrequency ablation improves the life quality of patients with the reduction of clinical signs.

Patients' arrangement for radiofrequency ablation: 12-lead ECG in patients before radiofrequency ablation; Holter monitoring, echocardiography are regular examinations for clinical assessment. MRI and CT are additional valuable methods of the study allowing to estimate atrial state, the degree of their fibrosis. These methods promote the reduction of thromboembolic disorders' risk during the ablation and the exclusion of left atrium thrombosis, especially left atrium appendage. Anticoagulant therapy preventing the clot formation should be performed after the exclusion of left atrium thrombosis during transesophageal echocardiography before the ablation (≤ 48 hours).

Catheter radiofrequency ablation can be accompanied by a series of less serious and serious complications – cough, dyspnea, hemoptysis, pneumonia, hypotonia, stethalgia, acute myocardial ischemia.

Recommendations by catheter ablation of left atrium

- Catheter ablation of atrial flutter, if atrial flutter is detected before the ablation or has appeared during the ablation of atrial fibrillation [*Jabaudon D et al., 2004*].
- The possibility of ablation during persistent atrial fibrillation refractory to antiarrhythmic therapy including amiodarone [*Jabaudon D et al., 2004; Singh B et al., 2005; Calò L et al., 2006*].
- The feasibility of catheter ablation in patients with paroxysmal form of atrial fibrillation with moderate increase of left atrium, in ineffectiveness of antiarrhythmic therapy including amiodarone [*Hsu L et al., 2004; Calò L et al., 2006*].

According to meta-analysis data the effectiveness of catheter ablation and antiarrhythmic therapy was 77% and 25%, respectively [*Auricchio A et al., 2007*].

The main reason of arrhythmia occurring after the ablation is atrial tachycardia according the mechanism of re-entry. Atrial fibrillation ablation is more effective at the early stage of the disease during the strategy of "cardiac rhythm control" [*Kirchhof P et al., 2009*] and was observed in 52% of patients.

Combination of radiofrequency ablation with the use of antiarrhythmic drugs promoted the absence of atrial fibrillation recurrences in 77% of patients [*Calkins H et al., 2009*]. Atrial fibrillation recurrences were more often observed in individuals with arterial hypertension and hyperlipidemia [*Ouyang F et al., 2010*].

Radiofrequency ablation method after a single procedure resulted in persistent preservation of sinus rhythm in 50-60% of patients, after retreatment – in 70-80% [*Calkins H et al., 2012*]. Catheter ablation is more effective in patients younger than 65 years without expressed structural heart changes.

In radiofrequency ablation indication the following significant factors should be taken into account:

- type of atrial fibrillation, size of left atrium, disease history data;
- presence and severity of heart disease leading to atrial fibrillation;
- alternative methods – antiarrhythmic drugs, control limits of heart rate;
- preference of patient to the supposed therapy.

Radiofrequency catheter ablation is more often indicated in patients with long-lasting paroxysmal atrial fibrillation which is resistant to antiarrhythmic drugs (at least to one). Such approach is based on several study results. According to D. Wilber and co-authors, the absence of atrial fibrillation in 1 year after the ablation was 66%, after antiarrhythmic drugs – 16% and according to Packer D and co-authors – 69.9% and 7.3%, respectively [*Wilber D et al., 2010; Packer D et al., 2013*].

Apparently, radiofrequency ablation is the method of choice during often progressing atrial fibrillation which is ineffective while using one or more antiarrhythmic drugs and normal sizes of left atrium according to echocardiographic data. Available not numerous data point out the considerable efficiency of ablation treatment [*Piccini J et al., 2009*].

Risks and benefits ratio of radiofrequency ablation is also turned out in patients with persistent and long-existing persistent atrial fibrillation, often progressing paroxysmal atrial fibrillation, without structural heart diseases. The age of patient, character of heart failure, size of left atrium, comorbidity, preference of patient should be taken into account in such cases.

There are reports on effectiveness of radiofrequency ablation in patients with atrial fibrillation and other accompanying diseases (heart failure). An increase in left ventricular ejection fraction and tolerance to physical activity were detected in such patients [*Hsu L et al., 2004*]. It is notable that antiarrhythmic therapy is recommended to be performed in patients with persistent atrial fibrillation and expressed structural heart failure before radiofrequency ablation.

The development of early and late heart rhythm disorders is possible after catheter ablation – attacks of paroxysmal tachyarrhythmia (atrial fibrillation, atrial flutter, supra-ventricular tachycardia); early arrhythmic disorders in the first 3 months after radiofrequency ablation; late recurrences of heart rhythm disorders – after 3 months of radiofrequency ablation conduction and very late from 1 to 5 years of attendance [*Themistoclakis S et al., 2008*].

Uncontrolled arterial hypertension, structural heart disorders are the factors promoting atrial fi-

brillation recurrences after radiofrequency ablation. Presence of normal and slightly increased anteroposterior size of left atrium (to 50 *mm*) in echocardiography is also essential.

The results of randomized studies show, that 56% of patients with persistent and long-existing persistent atrial fibrillation held sinus rhythm after radiofrequency ablation [*Hummel J et al., 2014*]. This is 2 times higher than in antiarrhythmic therapy (26%). The effectiveness of catheter ablation in progressing of atrial fibrillation attacks is about 40-50%, in long term persistent atrial fibrillation – 30-40%, which are significantly lower compared to paroxysmal form of atrial fibrillation [*Calkins H et al., 2009*].

Persistent atrial fibrillation, apparently, is an independent factor of late recurrences of atrial fibrillation; clinical effect achievement is less in present form [*Haegeli L, Calkins H, 2014*].

Structural heart diseases, systolic dysfunction of left ventricle, uncontrolled arterial hypertension, elderly age, female sex, sleep apnea syndrome, CHADS score≥2, fibrosis of left atrium according to cardiac MRI data are predictors of low efficacy[*Themistoclakis S et al., 2008; Haegeli L, Calkins H, 2014*].

Maximal number of arrhythmic recurrences after radiofrequency ablation of *pulmonary vein* performed due to paroxysmal and persistent forms of atrial fibrillation occur in early postablation period (in first 3-6 months after the procedure) [*Andrade J et al., 2012; Haegeli L, Calkins H, 2014*]. The absence of atrial fibrillation recurrences in first 6 weeks after radiofrequency ablation was the predictor of their absence for next 6 months.

The duration of early postablation arrhythmia also impacts on the risk of heart rhythm disorder recurrences [*Berkowitsch A et al., 2005*].

Repetitive radiofrequency ablation is a more effective method than standard antiarrhythmic therapy in the prevention of progression and the development of arrhythmias after the ineffectiveness of primary radiofrequency ablation.

It is considered that radiofrequency ablation of *pulmonary vein* s ostia is one of the effective nonpharmacologic methods of sinus rhythm control at present.

The choice of rational antiarrhythmic therapy after radiofrequency ablation of *pulmonary vein* is an actual question directly connected to long-term prognosis. Antiarrhythmic therapy is recommended in first 3 months (to 6 months) after radiofrequency ablation of *pulmonary vein* operation performed due to paroxysmal and persistent forms of atrial fibrillation [*Berkowitsch A et al., 2005; Gu J et al., 2012*].

It is necessary to reveal what antiarrhythmic drugs should be preferred for the prevention of atrial arrhythmias' recurrences after radiofrequency ablation in patients with paroxysmal and persistent atrial fibrillation.

The absence of preventive antiarrhythmic effect in flecainide, ethacyzin, allapinin treatment is shown in the series of studies in patients after radiofrequency ablation of *pulmonary vein* both in early and long-term periods [*Berkowitsch A et al., 2005; Hayashi M et al., 2014*]. Amiodarone authentically reduced the rate of patients' hospitalization because of paroxysmal tachycardia recurrences (57%) and cardioversions (64%) during 3 month period. Positive effect of amiodarone on the reduction of cardioversions in patients with persistent atrial fibrillation was preserved to 6 months.

The effectiveness of propafenone in the prevention of early recurrences of atrial fibrillation was confirmed by less duration (≈62×) of paroxysms according to data of Holter monitoring of ECG. Apparently, the administration of propafenone to patients with paroxysmal form of atrial fibrillation reduces hospitalization or cardioversion rate after radiofrequency ablation of *pulmonary vein* ostia without increased risk of serious adverse effects due to long-lasting use of antiarrhythmic drugs.

There are series of clinical studies related to antiarrhythmic therapy immediately after radiofrequency ablation of pulmonary veins ostia for the reduction of the risk of paroxysmal tachycardia's early recurrences. Effective radiofrequency ablation without antiarrhythmic therapy was detected only in 40.7% of patients, among those 43.7% – with paroxysmal atrial fibrillation, 30.2% – with persistent atrial fibrillation and 36.7% – with long-lasting persistent atrial fibrillation [*Arbelo E et al., 2014*].

In conclusion, an individual approach should be applied to the patient suffering from radiofrequency ablation due to paroxysmal or persistent atrial fibrillation. The administration of antiar-

rhythmic therapy should be based on accurate maintenance of sinus rhythm. The detection of predictors of atrial fibrillation recurrences and rational treatment of cardiovascular diseases pathogenetically connected to the development of atrial fibrillation are necessary.

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