IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 18, Issue 10 Ser.12 (October. 2019), PP 06-12
www.iosrjournals.org

Staged Catheter Ablation of Atrial Fibrillation, Long-Term Results

O.Goriachyi
Ukraine, Odesa, Ukrainian Scientific Research Institute of transportmedicine Ukraine, Odesa, Odessa regional clinical hospital
Corresponding Author: O.Goriachyi

Keywords: atrial fibrillation, zones of complex fractional activity, left atrial remodeling.

Date of Submission: 08-10-2019 Date of Acceptance: 24-10-2019

I. Introduction

Over the past 10 years, catheter radiofrequency ablation (CRA) has played an important role as an alternative treatment for atrial fibrillation (AF).

Antral pulmonary vein (LV) ablation is the most common strategy in patients undergoing atrial fibrillation (AF) [4]. However, the individual success rate of this approach is relatively better in patients with paroxysmal form than with persistent [6,10,11, 14]. The inconsistency of the results indicates a difference in the underlying mechanisms of the AF [10]. The early theories of the AF take the leading position in the trigger mechanism. However, the duration of arrhythmia leads to corresponding changes in the substrate, which promotes the persistent form of AF [11]. As a result, there is a need for additional substrate modification in this cohort of patients [9]. To date, among the many strategies for modifying the electrophysiological substrate, the leading role is played by the ablation of complex fractionated activity (CFA) zones, additional linear influences, treatment of the coronary sinus zone (CS) and target ganglionic plexuses (GP) [12]. However, it remains unclear whether additional modification of the substrate after the antral isolation of LV in the remote postoperative period in this group of patients increases the effectiveness of the procedure [8,13].

The purpose of the work is to evaluate the remote effects of the electrophysiological substrate modification procedure in patients with long-standing AF (LSAF).

II. Materials and Methods

The study included 160 patients with TFPP, more than one year in length and resistant to drug therapy, who were treated and examined at the Regional Cardiac Surgery Center at the Odessa Regional Clinical Hospital in 2010-2013.

The average age of the whole group is 60.4±9.5 years (75.6% of men and 24.4% of women). Duration of arrhythmic anamnesis 6.3±3.4, duration of the last episode of AF 13.9±3.2 months. The use of combinations of antiarrhythmic drugs I, III classes with no positive effect (average 2.1±0.9 antiarrhythmic drugs). Average number of attempts at cardioversion 3.2±0.8 per patient.

For the prevention of systemic thromboembolism, all patients in 1 month. before ablation and 2 months. after ablation, warfarin was administered in an individual dose under the control of EOM 2-3.

Depending on the type of surgical treatment performed, patients were divided into groups: Group I (n=77) performed the Box Lesion procedure according to the C.Pappone method; including: 1a group (39 people, 51%) - without additional impact on the zones of complex fractionated activity (CFA); 1b group (38 people, 49%) with additional zone impact (CFA);

Group II (n=83) underwent a stepwise modification of the electrophysiological substrate (EMEC) (linear LV isolation, posterior LP wall isolation, left isthmus ablation, additional ablation lines along the anterior LP wall, coronary sinus); including: group 2a (40 people, 48%) - without additional impact on the zones of complex fractionated activity (CFA); 2b group (43 people, 52%) with additional zone impact (CFA).

Electroanatomical mapping was performed under the NavX navigation system (St. Jude Medical, USA).Under combined anesthesia, according to the method of Seldinger, the right femoral and left subclavian veins were punctured twice. Under fluoroscopic control of "Siemens Arcadis" (Germany), the following electrodes were performed in the right heart departments:

8-10 pole electrode was conducted through the left subclavian vein and was installed in the coronary sinus (CS), for the registration of electrograms of the posterior-basal divisions of the left atrium and left ventricle. The inter-electrode distances ranged from 0.5 to 5 mm.

The 4-pole electrode was conducted through the right femoral vein and was installed in the region of the septum for the registration of spikes of P. Gis and electrographs of PP and PS.

To access the left atrium (except for patients who had an open oval window), a long PREFACE ™ Biosense Webster-8F conductor was performed through the right femoral vein in the PP, and a puncture needle was performed. Under fluoroscopic and echocardiographic control, the needle was positioned, in the area of the oval fossa, and a transseptal puncture was performed. The pressure in the LP was measured. After that, the needle was removed and a HIGH FLOW angiographic catheter - 7F was run through the conductor and fixed 2-3 cm inside the left superior pulmonary vein (LVLV). Using a contrast agent Omnipak (Iohexol) in the amount of 5-7 ml. selective angiography of LVLV was performed. Further, the catheter for angiography was sequentially performed in all LVs and their angiography was performedFig.1).

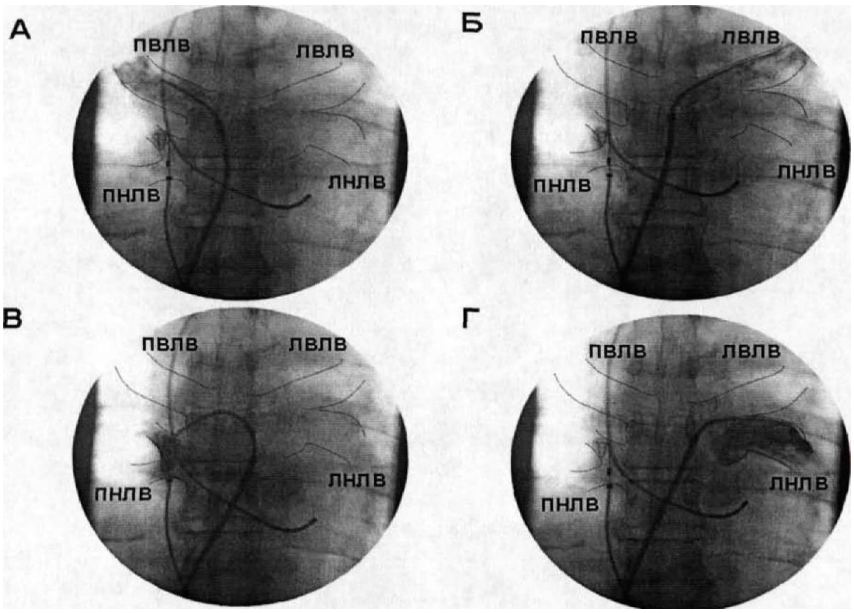

Figure 1. Radiographs of the patient. Dashed lines outline the contours of the pulmonary veins. A - contrast of the right upper pulmonary vein; B - a contrast of the left upper pulmonary vein; D - a contrast of the right inferior pulmonary vein; D - a contrast of the left inferior pulmonary vein.

Construction of 3D geometry of the left atrium was performed using the NavX Navigation System (St.Jude, USA). NavX mapping parameters were set in "CFE-mean," an interval analysis algorithm that measures the average fractionation of each site and renders them color mapping, visually representing the location of the CFA zones(Fig. 2).

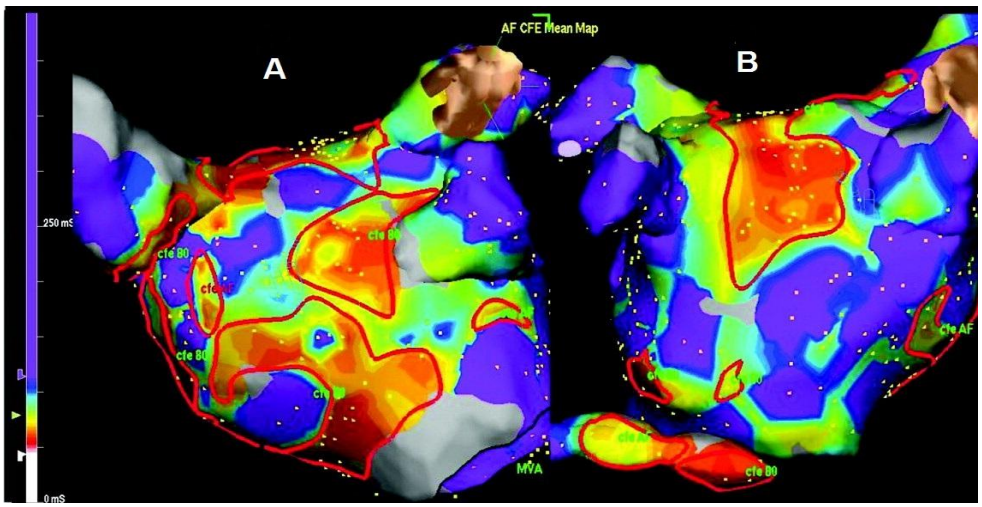

Figure 2. An example of a three-dimensional spatial reconstruction of the LP in CFE-mean mode. A-front projection. In-rear projection. Areas with complex high-frequency fractional activity, blue-normal excitation of the atrium are represented in red.

Electrograms (EGS) obtained were analyzed using St.Jude Medical equipment, EP Workmate, USA. Next, a frequency filter with parameters of 30-250 Hz was applied to the EG and displayed at a speed of 100 mm / s. (Fig. 3).

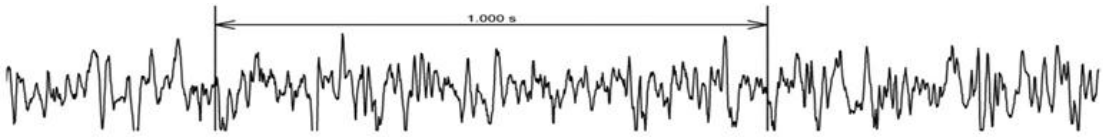

Figure 3. Electrogram of complex fractional activity of the left atrium.

The segmental model of the left atrium with the marking of the most fractionated complexes was used as an anatomic landmark of CFA zones (Fig. 4).

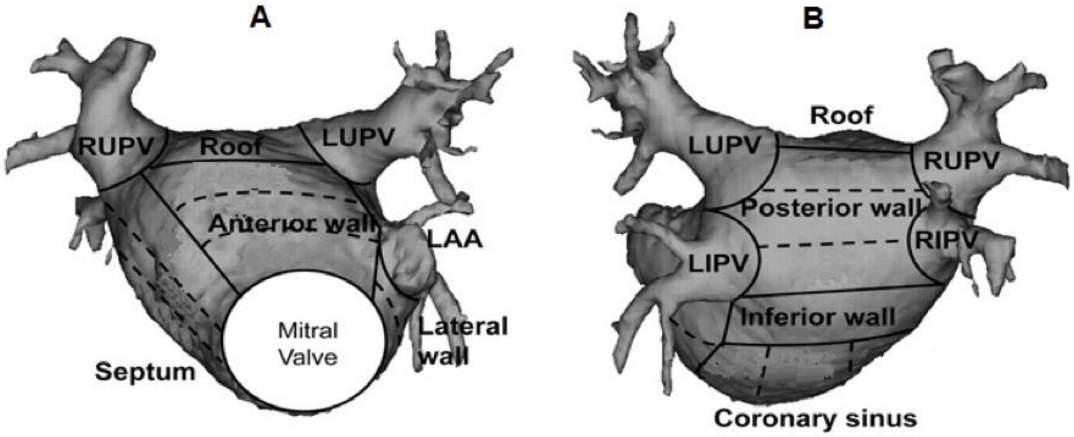

Figure4. Segmental model of LA. A-front projection. B-rear projection.

RUPV-right upper pulmonary vein, LUPV- left upper pulmonary vein, LIPV- left inferior pulmonary vein, RIPV- right inferior pulmonary vein.

After each procedure, a rebuilding of the CFA map was performed, with subsequent analysis of possible changes in the target potentials.

C.Pappone procedure

In patients of the first group (n = 77), ablation was performed with an irrigated electrode (7.5 Fr, NaviStarThermoCool, Biosense Webster, USA), which delivered radiofrequency energy (IBI - 1500T, St. Jude Medical) to the substrate with parameters of 42 ° C. , 35-40 W, at irrigation rate of 12 ml / min. The duration of each application was 45-60 seconds.

In the course of ablation, a series of point-to-point influences created a circular closed line around the right / left LV at a distance of 3-10 mm from the anatomical mouth. After that, a line was created between the isolated collectors on the roof of the left atrium, ablation of the left atrial "isthmus" was performed from the fibrous ring of the mitral valve to the lower pole of the left collector.

The isolating effect of the additional lines was evaluated when constructing the activation map, after which in the propagation-map mode the dynamics of activation of the left atrial isthmus and the roof of the LA to the created lines were evaluated and the complete blockade of holding at their level was documented.

Step-by-step elimination of AF

In patients of the second group (n = 83) the first stage was performed isolation of the mouth of the pulmonary veins by the method Box Lesion with additional effects on the anterior and posterior wall of the LP, endo and epicardial influence on the coronary sinus (COP). The second stage was the ablation of CFA zones. An irrigation electrode (7.5 Fr, NaviStarThermoCool, Biosense Webster, USA) was used for ablation, which delivered radiofrequency energy (IBI - 1500T, St.Jude Medical) to the substrate with parameters of 42 ° C, 35-40 W, at an irrigation rate of 12 ml. /min. The duration of each application was 45-60 seconds. The endpoint of the procedure was the disappearance of CFA potentials in these areas with the registration of an isoelectric line (Fig. 5).

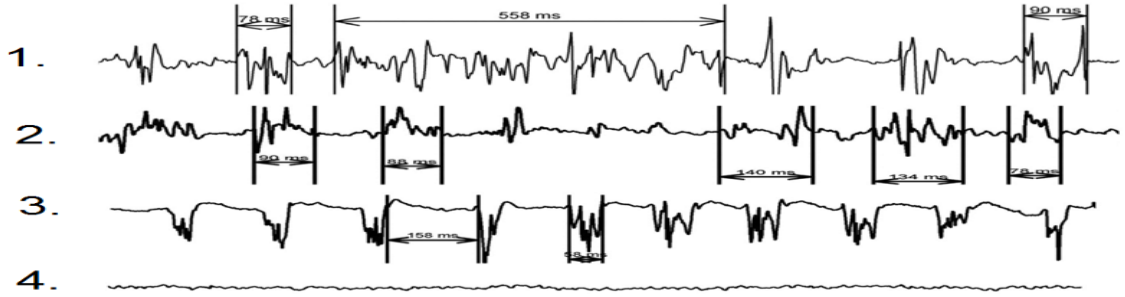

Figure 5. Dynamic change of CFA zones during ablation: 1. Primary CFA zone 2. Ablation-organization of CFA 3. Reduction of high-frequency component 4. Achieving effect.

The evaluation of the ablation efficiency of the CFA zones was performed when the PL activation map was reconstructed (Fig. 6).

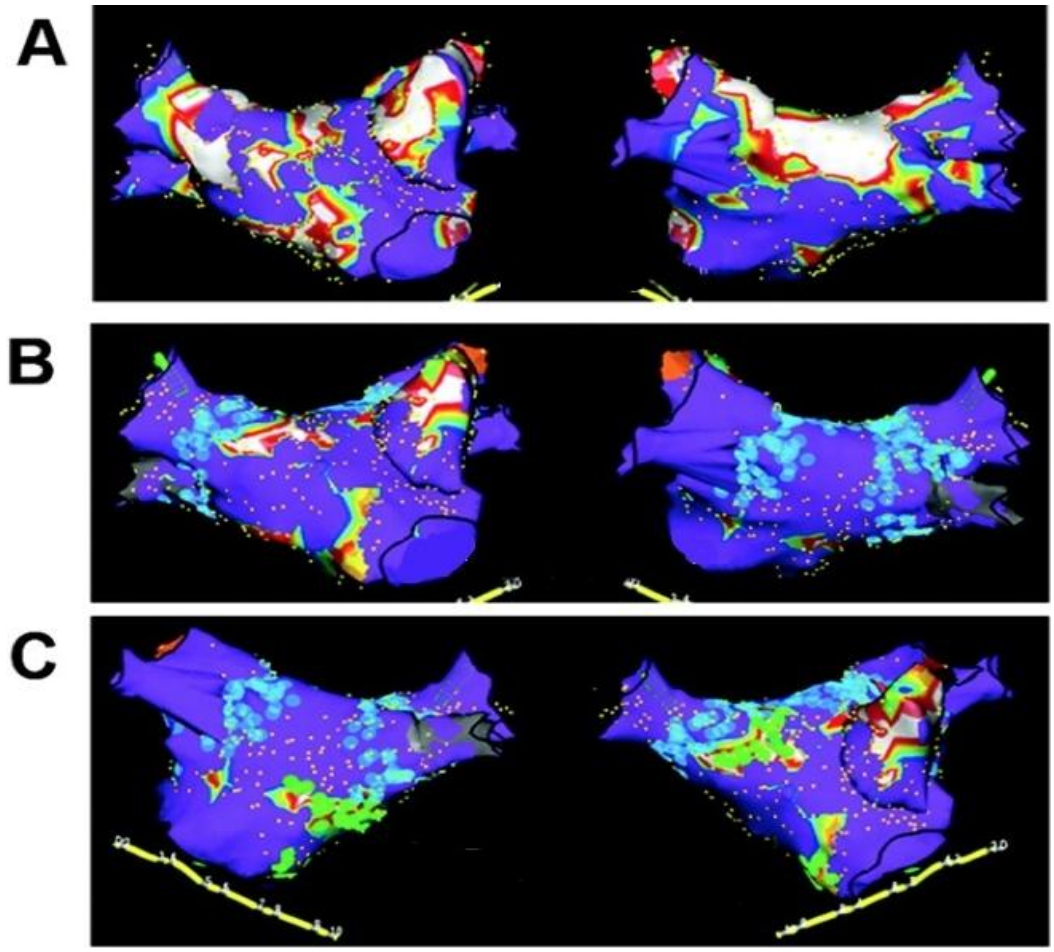

Figure 6. 3-D reconstruction of CFA zones. A-to ILV. B- after ILV. C-combined technique.

At the end of the procedure, all patients underwent an attempt to electrically induce AF by stimulating stimulation of pairs of CSprox and CSdist at a frequency of 200 to 400 pulses per minute with the repetition of this sequence against the background of pharmacological provocation - intravenous infusion of isoproterenol (0.5-3 mcg/min).

III. Results and Discussion

In the process of RFA continuous registration of the intracardiac electrograph of the COP was carried out. In case of arrhythmia relief effect - the electrogram was recorded from the moment of the beginning of the action with the subsequent analysis of the nature of the change in electrical activity. In the case of spontaneous

transformation of atrial fibrillation into typical flutter, the second stage was ablation of the cavotricuspid isthmus. While maintaining AF after ablation, electrical cardioversion was performed.
The efficiency of sinus rhythm recovery is presented in table 1:

Table 1 Sinusrhythm recovery effectiveness

	SR (n=60) 37,5%	AF–SR (n=36) 22,5%	Overallefficiency 61%
SubgroupIa, n=39	12 (30,7%)	8 (20,5%)	20 (51,2%)**
SubgroupIb, n=38	14 (35,8%)	8 (20,5%)	22 (56,3%)**
SubgroupIIa, n=40	16 (41%)	10 (25,6%)	26 (66,6%)*
SubgroupIIb, n=43	18 (46%)	10 (25,6%)	28 (71,6%)*

Note: SR - sinus rhythm, AF - atrial flutter, * - p <0.05, when comparing group I and group II; ** - p <0.05, when comparing subgroups a and b.
In the early postoperative period (7 days), 24 (28.9%) patients of group I and 14 (16.9%) patients of group II experienced attacks of AF, which were easily eliminated by intravenous procainamide (1000 mg) or amiodarone (300 mg). for 35±21.1 minutes Table 2 data

Table 2 Early postoperative period

Index	SubgroupIa,	SubgroupIIa,	SubgroupIb,	SubgroupIIb,
Atrial fibrillation relapse	8 (5%)	6 (3.75%)	4 (2.5%)	2 (1.2%)
Atrial flutter relapse	6 (3.7%)	4 (2.5%)	5 (3.1%)	3 (1.9%)

The most common complications were hip hematomas – 5% of patients. All other complications are presented in table 3

Table 3 Complications of the catheter procedure

Index	**Amount**	**%**
Arteriovenous fistula	2	1.3
Femoral pseudoaneurysm	1	0.6
Hematoma	8	5
Abdominal hematoma	1	0.6
A tamponade effusion	1	0.6
Heart tamponade	1	0.6
LV stenosis	1	0.6
Atrial-esophageal fistula	0	0
Paresis of the diaphragmatic nerve	1	0.6
Vaginal nerve lesions	1	0.6
Hypervolemia of the small circle of circulation	0	0
Air embolism	0	0
Envelope artery thrombosis	0	0
The total number of complications	17	10.6

Antiarrhythmic drugs, namely Cordarone, were administered to all patients within three months of the procedure to prevent iatrogenic arrhythmias and to provide the best conditions for reverse electrical remodeling.

The follow-up schedule included an examination every three months after the procedure to evaluate the patient's clinical condition and conduct daily ECG monitoring and echocardiography. In the case of positive dynamics (absence of atrial tachyarrhythmia), three months after ablation, the anticoagulants, and antiarrhythmic drugs were discontinued.

The evaluation of AF was performed by the Kaplan-Meier method, following international guidelines, which considered the recurrence of atrial fibrillation by any attack of atrial tachyarrhythmia lasting more than 30 seconds and occurred 3 months after surgical treatment [4]. During the observation period (12 + 3 months), the rhythm of AF was observed in 20 (12.5%) patients of group I and 7 (4.4%) patients of group II (p = 0.022). The rhythm of TP was observed in 16 (10%) patients of group I and 9 (5.6%) patients of group II (p = 0.022). Table 4

Table 4 Remote postoperative period of 12 months.

Index	SubgroupIa,	SubgroupIIa,	SubgroupIb,	SubgroupIIb,
Fibrillation relapse	11(6.9%)	9(5.6%)	5(3.1%)	2(1.3%)
Flutter relapse	9(5.6%)	7(4.4%)	5(3.1%)	4(2.5%)

During the observation period (25 + 6 months) the rhythm of AF was observed in 27 (16.8%) patients of group I and 15 (9.3%) patients of group II (p = 0.022). The rhythm of TP was observed in 22 (13.7%) patients of group I and 17 (10.6%) patients of group II (p = 0.022) Table 5

Table 5 Remote postoperative period of 25 months.

Index	Subgroup Ia,	Subgroup IIa,	Subgroup Ib,	Subgroup IIb,
Fibrillation relapse	16(10%)	11(6.8%)	9(5.6%)	6(3.7%)
Flutter relapse	12(7.5%)	10(6.2%)	10(6.2%)	7(4.4%)

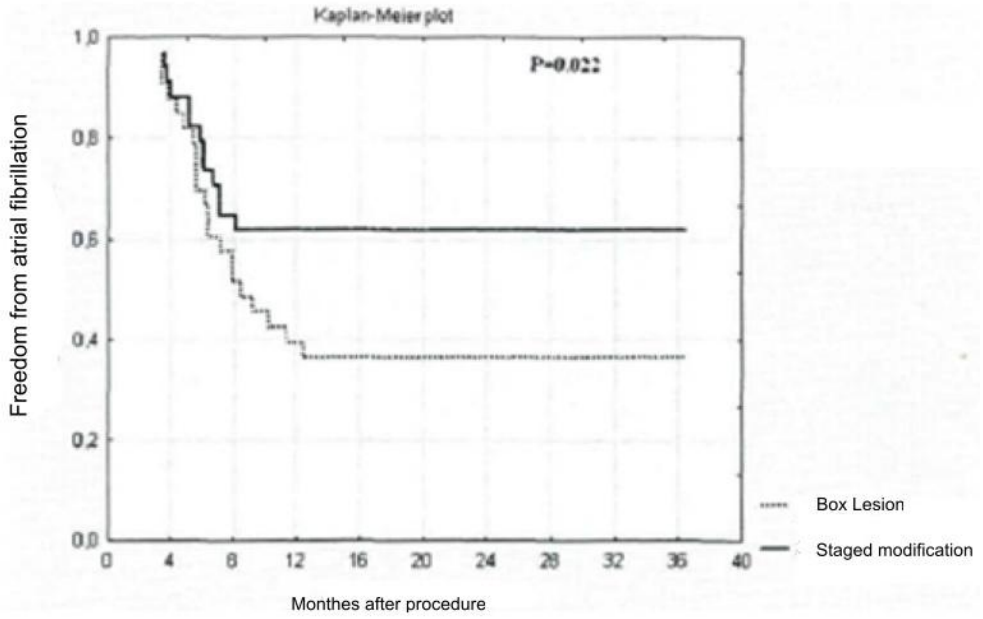

Fig. 7 Freedom from atrial fibrillation.

The total number of repeat procedures in both groups was 30.4%. For group I - 20.8%, group II - 9.6% (p = 0.021; Fig. 8).

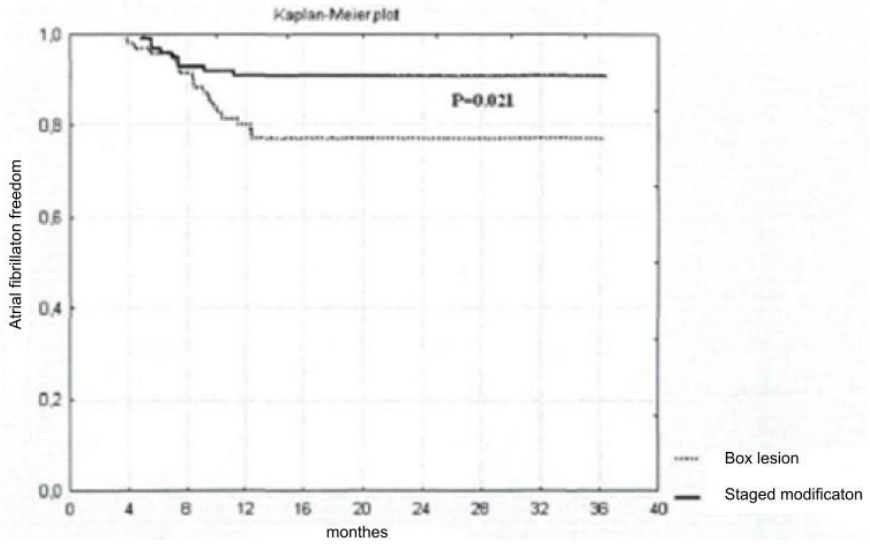

Figure 8 Freedom from repeat procedures in patients in both groups.

The data of repeated interventions are presented in table 6.

Table 6. Repeated catheter ablation

Index	I (n=77)	II (n=83)	P
The first re-intervention. %	14.3	7.2	0.046
The second repeated intervention. %	5.2	2.4	0.022
The third repeated intervention. %	1.3	0	0.012

Left atrial flutter. %	16.9	4.8	0.0006
All repeated interventions. %	20.8	9.6	0.0021

The complications of repeated interventions were:
-hemopericardium - in patients of group I (n = 2; 2.6%).
- arterio-venous fistula - in patients of group I (n = 4; 5.2%) and in patients of group II (n = 3; 3.6%).
None of these complications caused disabling effects and did not result in death.

The study showed that the method of modification of the electrophysiological substrate increases the effectiveness of the procedure in patients with chronic AF resistant to drug therapy and significantly reduces the number of recurrences of AF in the long term [1-3,7].

Elimination of ectopic activity during the procedure creates a massive zone of influence on both the CFA and the largest accumulation of neural structures located in the area of contact with the LV on the lower surface of the mouth of the right and left LV, as well as on the front and back surfaces of the mouth of the right and left LV [3] and the free surface of the left atrium.
Substrate re-modification also occurs in the following procedures.

Ablation of areas with complex and fractional electrical activity (CFA) as well as the creation of ablation lines on the roof of the LV and in the area of the mitral isthmus is considered necessary for the treatment of long persistent AF [4, 5]. The likelihood that repeated procedures can have a cumulative effect will continue to have a significant impact on the modification of the electrophysiological substrate is extremely high. [2, 5].

IV. Conclusions

1. Modification of the electrophysiological substrate is the most appropriate treatment for patients with chronic AF.
2. The expansion of the impact zones facilitates the modification of more pathophysiological mechanisms involved in AF support.

References

[1]. Callans D J., Gerstenfeld E. P., Dixit S. et al. Efficacy of repeat pulmonary vein isolation procedures in patients with recurrent atrial fibrillation // J. Cardiovasc. Electrophysiol. - 2004. - V.15. - P. 1050-1055.
[2]. Calo L., Lamberti F., Loricchio M. L. et al. Left atrial ablation versus biatrial ablation for persistent and permanent atrial fibrillation: a prospective and randomized study // J. Am. Coll. Cardiol. - 2006. - V.47. - P. 2504 -2512.
[3]. Cappato R., Calkins H. , Chen S.A. et al. Prevalence and causes of fatal outcome in catheter ablation of atrial fibrillation // J. Am. Coll. Cardiol. - 2009. - V.53(19). - P. 1798-1803.
[4]. Cappatto R, Calkins H, Chen Set al. Updated worldwide survey on the methods, efficacy and safety of catheter ablation for human atrial fibrillation// Circ. Arr.Electroph. - 2010. - V.3. - P. 32 - 38.
[5]. Chen M. S., Marrouche N. F., Khaykin Y. et al. Pulmonary vein isolation for the treatment of atrial fibrillation in patients with impaired systolic function // J. Am. Coll. Cardiol. - 2004. - V.43. - P. 1004 -1009.
[6]. Dixit S, Gerstenfeld EP, Callans DJet al. Single procedure efficacy of isolating all versus arrhythmogenic pulmonary veins on long-term control of atrial fibrillation: a prospective randomized study// H. Rhythm. – 2008. – V.5. – P. 174–181.
[7]. Dixit S., Gerstenfeld E. P., Callans D. J. et al. Comparison of cool tip versus 8-mm tip catheter in achieving electrical isolation of pulmonary veins for long-term control of atrial fibrillation: a prospective randomized pilot study // J. Cardiovasc. Electrophysiol. - 2006. - V.17. - P. 1074 -1079.
[8]. Elayi CS, Verma A, Di Biase Let al. Ablation of long standing permanent atrial fibrillation: results from a randomized study comparing three different ablation strategies// H. Rhythm. – 2008. – V.5. – P. 1658–1664.
[9]. Haissaguerre M, Hocini M, Sanders Pet al. Catheter ablation of long lasting persistent atrial fibrillation: critical structures for termination// J. Card. El. – 2005. – V.92. – P. 1138–1147.
[10]. HRS/EHRA/ECAS Consensus Statement on Catheter and Surgical Ablation of Atrial Fibrillation: Recommendations for Personnel, Policy, Procedures and Follow-up// H. Rhythm. – 2007. – V.4. – P. 816–861.
[11]. Maurits CEF, Wijffels MD, Charles JHJet al. Atrial fibrillation begets atrial fibrillation: a study in awake chronically instrumented goats// Circ. – 1995. – V.92. – P. 1954–1968.
[12]. Nademanee K, McKenzie J, Kossar E et al. A new approach to catheter ablation of atrial fibrillation: mapping of the electrophysiologic substrate// J. Am. Coll.Cardiol. – 2004. – V.43. – P. 2044–2053.
[13]. Oral H, Chugh A, Good E et al. Radiofrequency catheter ablation of chronic atrial fibrillation guided by complex electrograms// Circ. – 2007. – V.115. – P. 2606–2612.
[14]. Oral H, Knight B P, Tada H et al. Pulmonary vein isolation for paroxysmal and persistent atrial fibrillation// Circ. – 2002. – V.105. – P. 1077–1081.

O.Goriachyi. " Staged Catheter Ablation of Atrial Fibrillation, Long-Term Results." IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), vol. 18, no. 10, 2019, pp 06-12.