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Catheter Ablation of Paroxysmal and Persistent Atrial Fibrillation in Patients with Secondary Atrial Septal Defect. Evaluation of the Results and Impact on the Quality of Life

Abstract

Introduction. The presence of atrial fibrillation (AF) in patients with secondary atrial septal defect (ASD) has significant impact on their quality of life (QoL) and reduces life expectancy. Current guidelines recommend catheter ablation (CA) for patients with AF in case of medical treatment failure, however, its use in patients with AF and ASD is still poorly studied.

The aim. To study the efficacy and safety of CA and its impact on the QoL in patients with AF and secondary ASD.

Materials and methods. In 2003-2023, 1408 patients with secondary ASD were treated at the National Amosov Institute of Cardiovascular Surgery of the National Academy of Medical Sciences of Ukraine. Of these, 54 patients who had AF and underwent the CA procedure were included in group 1 of our study. There were 36 (66.7%) men and 18 (33.3%) women aged 24-76 years (mean age 61.4 ± 9.8 years). Four (9.3%) patients had persistent AF and 50 (90.7%) patients had paroxysmal AF. Fifty-six patients with paroxysmal or persistent AF and with the comparable age, duration of symptoms and associated pathology but without ASD were examined as group 2.

The type and results of surgical interventions were analyzed according to surgical reports. The results of the treatment and QoL were assessed using the Atrial Fibrillation Effect on Quality-of-Life (AFEQT) questionnaire during the follow-up period 1, 2 and 3 months after the procedure.

Results. Pulmonary vein isolation was performed in all 54 (100%) patients of the group 1, as well as cavotricuspid isthmus ablation in 26 (48.2%) cases, cavotricuspid isthmus ablation and left atrial linear ablation in 2 (3.6%) cases. Type, length and complication of the procedure were comparable to those in the group 2. Fourty-four (81.5%) patients with ASD were free from AF 3 months after procedure, and their results did not differ from those obtained in the group 2 ($p > 0.05$). Average QoL indicators according to AFEQT significantly improved in both groups of patients who underwent CA. The differences in post-treatment QoL between patients of both groups were insignificant ($p > 0.05$).

Conclusions. CA was found to be safe and beneficial in patients with AF and secondary ASD. The rate of procedural complications and cure rate in patients with AF and secondary ASD (81.5%) were compatible to those in patients without ASD (80.5%). AF has negative effect on the main indicators of the patient's life. In patients with secondary AF with ASD who underwent CA, a significant improvement in AF symptoms and QoL according to the AFEQT questionnaire (total score 56.1 ± 2.7 before the procedure vs. 78.7 ± 4.0 at follow-up) was noted.

Keywords: *cardiac arrhythmia, congenital cardiac anomalies, pulmonary vein isolation, treatment outcome.*

Introduction. Atrial fibrillation (AF) affects more than 1% of people in the world, and near 9% of people over the age of 75 [1]. The risk of AF depends on age, heredity and various clinical variables, concomitant heart pathology, different congenital heart diseases, including secondary atrial septal defect (ASD) [2, 3]. The prevalence of AF in patients with ASD can reach up to 50% till the age of 60 years and has significant impact on their quality of life (QoL) and reduces life expectancy [4].

The survival rate of patients with AF and ASD has increased lately, but sufficient evidence on their best management is still lacking [5]. Recent guidelines recommend catheter ablation (CA) (pulmonary veins isolation [PVI]) for patients with persistent and paroxysmal AF in case of failure of medical treatment with class I or III antiarrhythmic drugs [6]. However, its use in patients with AF and ASD is still limited and most of the existing evidence is based on few studies and warrants further research for improv-

ing patient outcomes [5]. In such circumstances, evaluation of the results of CA and its impact on the outcomes in patients with AF and ASD is mandatory.

The aim. To study the efficacy and safety of CA and its impact on the QoL of patients with AF and secondary ASD.

Material and methods. In 2003-2023, 1408 patients with secondary ASD were treated at the National Amosov Institute of Cardiovascular Surgery of the National Academy of Medical Sciences of Ukraine. Of these, 54 patients who had AF and underwent the CA procedure were included in the group 1. There were 36 (66.7%) men and 18 (33.3%) women aged 24-76 years (mean age 61.4 ± 9.8 years). Four (9.3%) patients had persistent AF and 50 (90.7%) patients had paroxysmal AF. Fifteen (27.8%) patients had first onset of AF during an attempt to close ASD with an occluder, in 39 (72.2%) patients AF was documented according to electrocardiography (ECG) and Holter monitoring. Two (3.7%) patients had ASD closure before CA, in 44 (81.5%) cases ASD was occluded after CA (43 defects were repaired through transcatheter closure and one with open heart surgery), and 8 (14.8%) patients rejected further treatment of ASD. Fifty-six patients (38 [67.9%] men and 18 [32.1%] women) with paroxysmal or persistent AF and with the comparable age, duration of symptoms and associated pathology but without ASD were also examined as group 2. Clinical and demographic data of the patients of both groups are summarized in Table 1.

All the patients from both groups were resistant to medical treatment and underwent transthoracic and transesophageal echocardiography.

Pre-procedure medication. Before 2011, all the patients prior to the procedure received warfarin with target international normalized ratio of 2.0-3.0 which was discontinued for bridging with low molecular weight heparin till international normalized ratio 1.0-2.0. Since 2011, non-vitamin K antagonists were introduced: apixaban, rivaroxaban, dabigatran were used in appropriate dosage. All the patients received anticoagulation therapy for at least one month after the procedure. And its further prescription was based upon the follow-up evaluation and the presence of AF. If no AF was seen, they were discontinued. For all cases we used typical antiarrhythmic protocol according to European Society of Cardiology Guidelines [7]. In case of an early AF recurrence, the patients received antiarrhythmic medication and anticoagulation therapy.

Table 1

Clinical and demographic characteristics of the study subjects

Characteristics	Group 1 (AF with ASD) (n = 54)	Group 2 (AF without ASD) (n = 56)
Sex, male/female, n (%)	36 (66.7) / 18 (33.3)	38 (67.9) / 18 (32.1)
Age, years	61.4 ± 9.8	61.2 ± 11.5
Persistent AF, n (%)	4 (9.3)	6 (10.7)
Paroxysmal AF, n (%)	50 (90.7)	50 (89.3)
Hypertension, n (%)	28 (51.9)	32 (57.1)
Diabetes mellitus, n (%)	1 (1.9)	2 (3.6)
Smoking, n (%)	2 (3.7)	3 (5.4)

Catheter ablation procedure. The procedures were made under general anesthesia, using Ziehm (Germany) and Toshiba (Japan) angiography machines. Radiofrequency ablation was performed using Shuttle EP (Stockert, Germany) and IBI (Abbott, USA) generators. Invasive electrophysiological evaluation was obligatory before the procedure. Registration of cardiac potentials was made with simultaneous ECG recording.

All the patients underwent CA according to the standard protocol using EnSite Velocity™ 3D mapping system (Abbott, USA) (Fig. 1). A 20-polar circular mapping catheter was positioned inside the pulmonary vein ostia, and a 20-polar electrode catheter was introduced into the coronary sinus through the right subclavian vein. A 3.5-mm irrigated tip catheter was used for mapping and ablation. The aim of CA was the achievement of bidirectional block between the left atrium and each pulmonary vein. During the procedure, we followed the concept of achieving electrical and anatomical isolation of the pulmonary veins with wide circular ablation of the orifices of the pulmonary veins.

Methodologically, CA procedure didn't differ in patients with secondary ASD and in those without it. However, two CA procedures were conducted in patients after endovascular repair of ASD through transseptal puncture (Fig. 2).

Procedural complications of CA were defined as stroke or transient ischemic attack, pericardial effusion, cardiac tamponade, esophageal injury, phrenic nerve paralysis, pericarditis, pulmonary vein stenosis and vascular complications (puncture site hematoma, vessel dissection or rupture).

Post-procedure monitoring was conducted in the intensive care unit for at least 24 hours. All the complications after the intervention were recorded.

The type and results of surgical interventions were analyzed according to the surgical reports. The treatment results were assessed during the follow-up period 1, 2 and 3 months after the procedure according to ECG and Holter monitoring.

At the final follow-up visit 3 months after the procedure each patient underwent 24-hour Holter monitoring and evaluation of the QoL. A documented AF more than 30 seconds was considered as AF recurrence. QoL was assessed using the Atrial Fibrillation Effect on Quality-of-Life (AFEQT) questionnaire.

Statistical analysis. Data are presented as median and range or as mean ± standard deviation. Both the Mann-Whitney U test and the Student's t-test were used to com-

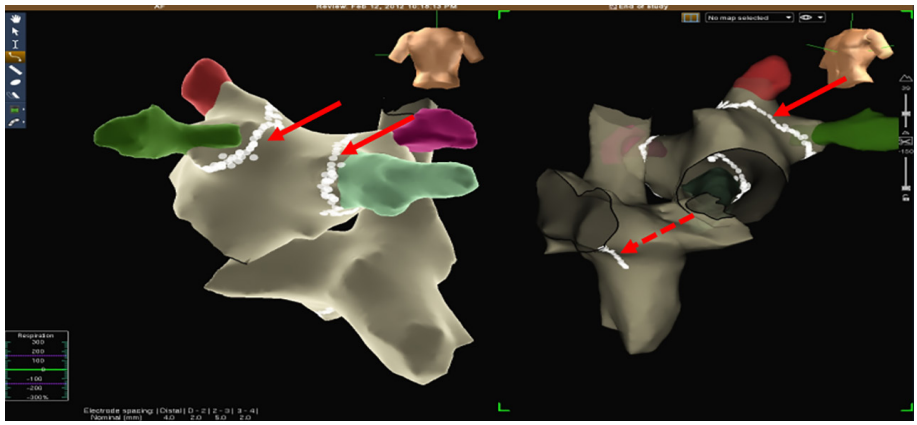

Fig. 1. *3D map of the left and right atria with the lines for radiofrequency ablation (arrows show wide circumferential PVI, dashed arrow shows line of the tricuspid isthmus)*

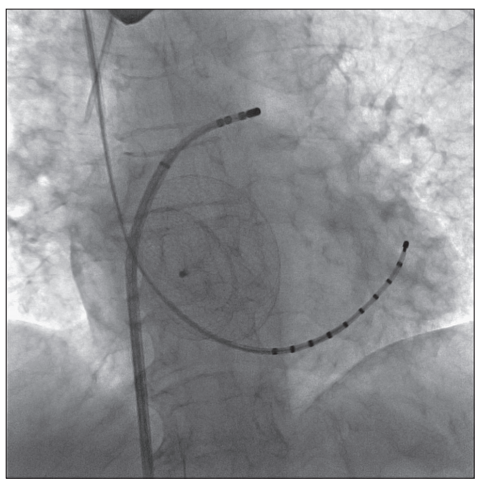

Fig. 2. *Transseptal puncture through the occluder during the procedure (sheath and catheter in the left atrium)*

pare continuous variables. Fisher's exact test or χ^2 were used for categorical variables. A value of $p < 0.05$ was considered as statistically significant. All statistical analyses were performed using SPSS v. 24 software (SPSS Inc., USA).

Assessment of QoL. QoL and AF symptoms were assessed at baseline and 3 months after CA using the AFEQT questionnaire which consists of 18 questions. The answers are rated using a Likert scale from 1 to 7. Questions 19-20 were related to the satisfaction with treatment and were not included in the evaluation of the QoL. The scores were transformed using a scale from 0 to 100, where a score of 0 corresponds to the most severe symptoms and limitations and 100 corresponds to no limitations or signs of the disease.

Results and discussion. PVI was performed in all 54 (100%) patients with AF and ASD and in 56 (100%) patients without ASD. Additional cavotricuspid isthmus ablation in patients of group 1 was done in 26 (48.2%) cases, left atrial linear ablation and cavotricuspid isthmus ablation in 2 (3.6%) cases. Similar data was seen in group 2, without statistical significance. The length of the procedures was also comparable in patients of both groups (Table 2).

Complications of CA in patients with AF and ASD occurred in 9 (16.6%) cases and didn't differ from corresponding indicators in the group without ASD, where they were seen in 10 (17.9%) cases ($p > 0.05$) (Table 3).

We didn't find stroke or transient ischemic attack, hemorrhage, esophageal bleeding, infection, phrenic nerve injury and other fatal or severe complications that cause morbidity in the patients with AF and ASD. We observed 2 (3.7%) cases of the local hematoma in the site of groin puncture, 4 (7.4%) cases of mild pericarditis, all of them

Table 2

CA procedural peculiarities in the study subjects

Parameters	Group 1 (AF with ASD) (n = 54)	Group 2 (AF without ASD) (n = 56)	p-value
Procedure time, min	204.3 ± 60.5	210.6 ± 72.5	> 0.05
Ablation strategy			
PVI total, n (%) / PVI alone, n (%)	54 (100) / 26 (48.2)	56 (100) / 26 (46.4)	– / > 0.05
Cavotricuspid isthmus line, n (%)	26 (48.2)	28 (50.0)	> 0.05
Cavotricuspid isthmus line and left atrium roof line, n (%)	2 (3.6)	2 (3.6)	–
Left atrium anterior wall, n (%)	0 (0.00)	0 (0.00)	–
Left atrium appendage, n (%)	0 (0.00)	0 (0.00)	–
Left atrium septum, n (%)	0 (0.00)	0 (0.00)	–

Table 3

Complications associated with CA in the study subjects

Complications	Group 1 (AF with ASD) (n = 54)	Group 2 (AF without ASD) (n = 56)	p-value
Death, n (%)	0 (0.00)	0 (0.00)	–
Pericarditis, n (%)	4 (7.4)	6 (10.7)	> 0.05
Local hematoma, n (%)	2 (3.7)	3 (5.4)	> 0.05
Bradycardia or hemodynamic instability, n (%)	1 (1.9)	2 (3.6)	> 0.05
Tamponade, n (%)	1 (1.9)	1 (1.8)	> 0.05
Transient ischemic attack, n (%)	0 (0.00)	1 (1.8)	> 0.05
Pulmonary vein stenosis, n (%)	0 (0.00)	1 (1.9)	> 0.05
Total, n (%)	9 (16.6)	10 (17.9)	> 0.05

required non-steroid anti-inflammatory drugs and in 2 cases colchicine was prescribed. In 1 (1.9%) case of cardiac tamponade, urgent pericardiocentesis was successfully provided during the procedure, without any consequences.

Also we found one case of severe pulmonary vein stenosis after CA in a patient without ASD 3 months after the procedure. The patient had sudden onset of dyspnea and hemoptysis after successful CA (Fig. 3). After endovascular correction of stenosis, the patient showed clinical improvement and was discharged.

On the first follow-up 1 month after CA, 46 (85.1%) patients of group 1 and 49 (87.5%) patients of group 2 were free from AF (p = 0.786). Next evaluation revealed small number of AF recurrence in both groups, however, their difference was insignificant, and on the final check 3 months after the procedure 44 (81.5%) patients of group 1 vs. 45 (80.5%) patients of group 2 were completely free from AF (p = 0.812) (Table 4).

Mean QoL indicators according to AFEQT significantly improved in patients after CA in both groups. In patients of group 1, post-treatment AFEQT total score was 78.7 ± 4.0 vs. 56.1 ± 2.7 on admission (p < 0.0001), symptom domain 84.8 ± 3.2 vs. 58.4 ± 3.1 (p < 0.0001), daily activity domain 71.9 ± 3.9 vs. 57.8 ± 2.1 (p < 0.0001), treatment concern domain 82.3 ± 3.7 vs. 51.2 ± 4.1 (p < 0.0001) according to the first and last survey, respectively (Table 5).

In patients without ASD, post-treatment AFEQT total score was 77.8 ± 3.9 vs. 56.3 ± 2.1 on admission, symptom domain 83.5 ± 2.9 vs. 57.9 ± 3.2 (p < 0.0001), daily activity domain 72.1 ± 4.1 vs. 57.1 ± 3.1 (p < 0.0001), treatment concern domain 83.6 ± 3.2 vs. 52.4 ± 3.3 (p < 0.0001) according to the first and last survey, respectively. The differences in post-treatment QoL between the groups were insignificant (p > 0.05) (see Table 5).

ASD is one of the most prevalent congenital heart defects in the world and occurs with the frequency of 1-2 cases per 1000 births [8, 9]. Most cases of ASD are well tolerated in the childhood, and its repair is often delayed until the age of 3-4 years. However, delayed repair of the defect has no benefit, because long-term hypervolemia of the pulmonary circulation leads to pulmonary hypertension and heart failure in patients in the 2nd-3rd decade of life. Severe cardiomegaly is a typical sign of "old" ASD and is accompanied by the development of mitral and tricuspid valve insufficiency. Stretching of the right and then the left atrium contributes to the appearance of atrial arrhythmias, among which AF is the most common and occurs in 15% of 40-year-old and 60% of 60-year-old patients [2, 3, 4]. Treatment of this cohort of patients remains critical.

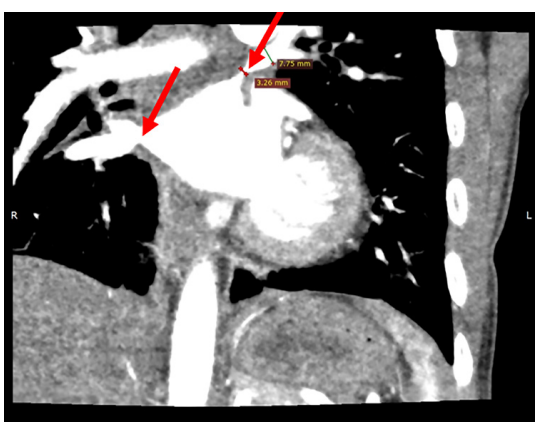

Fig. 3. *Computed tomography angiogram shows critical stenosis of right superior and left superior pulmonary veins (arrows)*

Table 4

CA efficacy in the study subjects 3 months after the procedure

Efficacy of the treatment	Group 1 (AF with ASD) (n = 54)	Group 2 (AF without ASD) (n = 56)	p-value
Complete freedom from AF after 1 month, n (%)	46 (85.1)	49 (87.5)	0.786
Complete freedom from AF after 2 month, n (%)	45 (83.3)	47 (83.9)	0.803
Complete freedom from AF after 3 month, n (%)	44 (81.5)	45 (80.5)	0.812

Table 5

Quality of life of the study subjects before and after CA

	Group 1 (AF with ASD) (n = 54)		Group 2 (AF without ASD) (n = 56)		
QoL assessment	Before treatment (I)	After treatment (II)	Before treatment (III)	After treatment (IV)	p-value
AFEQT Total	56.1 ± 2.7	78.7 ± 4.0	56.3 ± 2.1	77.8 ± 3.9	I-II < 0.0001 II-IV > 0.05
AFEQT Symptoms	58.4 ± 3.1	84.8 ± 3.2	57.9 ± 3.2	83.5 ± 2.9	I-II < 0.0001 II-IV > 0.05
AFEQT Daily Activities	57.8 ± 2.1	71.9 ± 3.9	57.1 ± 3.1	72.1 ± 4.1	I-II < 0.0001 II-IV > 0.05
AFEQT Treatment Concern	51.2 ± 4.1	82.3 ± 3.7	52.4 ± 3.3	83.6 ± 3.2	I-II < 0.0001 II-IV > 0.05

Even in adults, repair of the ASD appears to improve survival, however, its impact on the incidence of AF remains controversial [10]. Authors proposed that ASD repair might help patients with AF or even help to avoid AF, but after closure patients with a history of AF are more likely to experience another episode [11, 12]. According to a meta-analysis, ASD closure, whether surgical or transcatheter, was associated with decrease in atrial tachyarrhythmias incidence, however, considering only AF, this difference wasn't statistically significant [13]. On the other hand, data showed no effect of ASD closure on the incidence of AF in the long term [14, 15], and similar prevalence of AF in patients undergoing surgical and nonsurgical ASD repair [16].

These results further demonstrate that in patients with ASD and pre-existing AF, transcatheter closure of ASD alone may not be adequate to avoid recurrent AF over the long run. For this reason, it is crucial to treat and, if at all possible, to prevent AF in case of ASD, but best treatment strategy remains unclear [10].

Despite the fact that CA demonstrates 70% of successful results in patients with AF during long-term follow-up [17], its efficacy in patients with congenital heart disease including ASD still remains limited [4, 9, 18]. Our data found CA to be safe and effective procedure for AF treatment in patients with ASD and demonstrated its positive impact on QoL among all AFEQT domains for 3 months. However, further studies are needed to clarify the best surgical approaches for prevention and treatment of AF in case of ASD, including research of first onset AF during the ASD closure, optimal strategy and technique of CA in case of scheduled implantation of ASD occluder.

Conclusions. CA was found to be safe and beneficial in patients with AF and secondary ASD. The rate of procedural complications and cure rate in patients with AF and secondary ASD (81.5%) were compatible to those in patients without ASD (80.5%). AF has negative effect on the main indicators of the patient's life. In patients with secondary AF with ASD who underwent CA, a significant improvement in AF symptoms and QoL according to the AFEQT questionnaire (total score 56.1 ± 2.7 before the procedure vs. 78.7 ± 4.0 at follow-up) was noted.

Conflict of interest. The authors have no conflicts of interest to declare.

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Катетерна абляція пароксизмальної та персистуючої фібриляції передсердь у пацієнтів з дефектом міжпередсердної перегородки. Оцінка використання та впливу на якість життя

Петканич М. М., лікар-хірург серцево-судинний відділення лікування складних аритмій з рентгеноопераційною

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Вступ. Наявність фібриляції передсердь (ФП) у пацієнтів з дефектом міжпередсердної перегородки (ДМПП) суттєво впливає на їх якість життя і збільшує ризик смертності. Станом на сьогодні відповідно до настанов катетерну абляцію рекомендують для пацієнтів з ФП у разі неефективного медикаментозного лікування, однак її застосування у пацієнтів з ФП та ДМПП вивчено недостатньо.

Мета – вивчити ефективність і безпеку катетерної абляції та її вплив на якість життя пацієнтів із ФП та ДМПП.

Матеріали та методи. Протягом 2003–2023 рр. у Національному інституті серцево-судинної хірургії імені М. М. Амосова НАМН України проліковано 1408 пацієнтів з ДМПП, з них у 54 (4,8 %) пацієнтів була проведена катетерна абляція з приводу ФП (група 1). П'ятдесят шість пацієнтів із порівнянним віком, тривалістю симптомів та супутньою патологією були проаналізовані для групи 2. Вид і результати хірургічних втручань аналізували за даними операційних протоколів. Результати лікування та якість життя оцінювали протягом періоду спостереження через 1, 2 та 3 місяці після процедури.

Результати. У чотирьох (9,3 %) із 54 пацієнтів із ДМПП була персистуюча ФП і у 50 (90,7 %) пацієнтів – пароксизмальна. Ізоляція легеневої вени виконана всім 54 пацієнтам (100 %) групи 1; лінійні абляції лівого передсердя (3,6 %) – у 2 пацієнтів, абляція каво-трикуспідального перешийка – у 26 пацієнтів (48,2 %). Тип, тривалість і складність процедури були зіставні з даними групи 2. Сорок чотири (81,5 %) пацієнти з ДМПП не мали ФП через

3 місяці після процедури, і їх дані не відрізнялися від результатів групи 2 (p > 0,05). Середні показники якості життя за опитувальником AFEQT серед пацієнтів обох груп достовірно покращилися у хворих, які перенесли катетерну абляцію і не відрізнялися між обома групами (p > 0,05).

Висновки. Катетерна абляція є безпечною та корисною у пацієнтів з ФП та ДМПП. У пацієнтів з ФП та ДМПП катетерна абляція мала подібний рівень процедурних ускладнень і ефективності (81,5 %) порівняно з групою без ДМПП (80,5 %). Фібриляція передсердь негативно впливає на основні показники життя хворих. У хворих з ФП та ДМПП після катетерної абляції відзначено достовірне покращення симптомів ФП та якості життя згідно з опитувальником AFEQT (загальна оцінка 56,1 ± 2,7 до лікування проти 78,7 ± 4,0 на контрольному обстеженні).

Ключові слова: *ізоляція легеневої вени, серцева аритмія, вроджені аномалії серця, якість життя, результати лікування.*

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