ABSTRACT

of the dissertation of doctoral student Kenzhebek Bizhanov on the topic: "Improving the management of patients with atrial fibrillation using modern methods of interventional treatment", submitted for the degree of Doctor of Philosophy (PhD) in the educational program "8D10102 - Medicine"

Relevance of the Study

Cardiovascular diseases remain the leading cause of mortality among all non-communicable diseases. Atrial fibrillation (AF) is the most common arrhythmia in adults and is a significant independent risk factor associated with increased cardiovascular morbidity and mortality. AF is observed in 0.12%-0.16% of individuals under 49 years old, 3.7%-4.2% of individuals aged 60-70 years, and 10%-17% of individuals aged 80 years and older. It also triggers life-threatening and disabling conditions such as stroke, dementia, progression of heart failure, and premature cardiovascular death.

Thus, AF places a significant financial burden on public healthcare, leading to social consequences and substantial economic losses worldwide and in our country. Catheter ablation has proven to be an effective method for restoring and preventing the recurrence of AF. However, several questions remain that require further research, including the importance of early AF ablation in preventing its progression and the correlation between the degree of atrial dilation/fibrosis and the success of future ablations.

Based on the above, the study's objectives and tasks have been formulated.

Research aim

To evaluate the effectiveness of cryoballoon ablation (CBA) and radiofrequency ablation (RFA) for catheter-based treatment of paroxysmal and persistent AF using data from implantable long-term ECG monitoring devices (REVEAL XT) and to improve the treatment algorithm for atrial fibrillation.

Research subject

The study focuses on AF recurrences recorded by implantable long-term ECG monitoring devices in the early and late postoperative periods after catheter ablation.

Research object

Patients with paroxysmal and persistent AF with a verified diagnosis before and after catheter-based cryoballoon and radiofrequency ablation.

Research tasks

1. Analyze the results of catheter-based AF treatment using data from implantable long-term ECG monitoring devices.
2. Compare the effectiveness of cryoballoon and radiofrequency ablation for paroxysmal and persistent AF in early and late postoperative periods using long-term ECG monitoring data.
3. Identify predictive factors (clinical and instrumental) for AF recurrence in the postoperative period after different catheter ablation methods.
4. Improve the treatment algorithm for persistent and long-standing persistent AF based on the obtained data.

Research Hypothesis

Long-term heart rhythm monitoring using implantable cardiac monitors (REVEAL XT) confirms that cryoballoon and radiofrequency ablation are highly effective catheter-based treatments for paroxysmal and persistent AF in both early and late postoperative periods. This contributes to improving the treatment algorithm for AF and enhancing clinical outcomes for this condition.

Scientific Novelty

1. For the first time in Kazakhstan, implantable long-term ECG monitoring devices (REVEAL XT) were used to study the effectiveness of interventional AF treatment.
2. A comparative analysis of different catheter ablation methods for AF patients was conducted in early and late postoperative periods using implantable long-term ECG monitoring devices (REVEAL XT).
3. Risk factors for AF recurrence after catheter ablation were studied.
4. An improved algorithm for interventional and surgical treatment of persistent and long-standing persistent AF was developed and registered under Author's Certificate No. 37325, dated June 20, 2023.

Practical Significance

1. The implementation of implantable long-term ECG monitoring devices (REVEAL XT) in clinical practice has provided more accurate data on the long-term effectiveness of different catheter ablation methods.
2. The study identified risk factors for AF recurrence after catheter ablation, which can be used to optimize prevention strategies.
3. The improved treatment algorithm (Author's Certificate No. 37325, June 20, 2023) can be applied in practical cardiology to enhance timely diagnosis, treatment strategies, and secondary prevention of AF-related complications such as cardioembolic stroke.
4. A database of AF patients with implantable long-term ECG monitoring devices (REVEAL XT) was created for inclusion in a national registry, allowing prospective monitoring and further analysis of catheter ablation effectiveness.

Personal Contribution of the Doctoral Candidate

The doctoral candidate analyzed the incidence rates and modern treatment methods for atrial fibrillation (AF) worldwide and in the Republic of Kazakhstan. The author's personal contribution includes designing the study protocol, recruiting and performing interventional treatment of patients, implanting insertable cardiac monitors (ICMs), collecting data, developing an individual registration card, forming a database, analyzing, summarizing, and interpreting the results of interventional AF treatment based on registered ICM data (REVEAL XT), conducting statistical analysis, improving the algorithm for interventional and surgical treatment of persistent and long-standing persistent forms of atrial fibrillation.

Relevance to the Main Scientific Research Plan

The dissertation was conducted within the framework of the Scientific and Technical Program "New Molecular-Genetic Methods for Pre-Symptomatic Diagnosis and Treatment of Significant Diseases" (Subtask 4.2: "Development of a Protocol for a Personalized Approach in the Treatment of Complex Forms of Atrial

Fibrillation") under Budget Program 013 "Applied Scientific Research in Healthcare." Funding – Ministry of Healthcare of the Republic of Kazakhstan. Contract No. 164/07.17 dated 10.07.2017, "Asfendiyarov Kazakh National Medical University." Study period 2017–2019.

The study protocols were reviewed and approved by the Local Ethics Committee:

A.N. Syzganov National Scientific Center of Surgery, No. 1 dated "28" June 2016; A.N. Syzganov National Scientific Center of Surgery, No. 2 dated 07.04.2017; Al-Farabi Kazakh National University, No. 2036/21 dated 12.06.2020.

Key Research Findings and Conclusions

1. Analysis of the results of catheter treatment of AF based on the registered records of implantable long-term ECG monitoring devices (REVEAL XT) showed the high efficiency of this treatment method in achieving the end point: the rate of freedom from arrhythmia after 12 months was 71%, after 24 months 67%.

2. Comparative evaluation of the effectiveness of various methods of interventional treatment of patients with persistent AF according to ICM data (REVEAL XT) in the immediate and late postoperative periods showed comparable effectiveness of both methods: after 12 months, 70% of patients in the CBA cohort and 72% in the RFA cohort achieved "freedom from arrhythmia" (p-0.628), and after 24 months - 68% in the CBA cohort and 66% in the RFA cohort (p-0.830).

3. A statistically significant prognostic risk factor associated with an increased chance of AF recurrence after catheter ablation, in multivariate analysis, was the anteroposterior size of the LA: an increase of 1 mm in the anteroposterior size of the LA gives an increase in the chances of developing AF recurrence by 1.56 (955 CI: 1.14-2.12) times after 12 months, by 1.61 (955 CI: 1.19-2.17) times after 24 months.

4. The developed algorithm for interventional and surgical treatment of persistent forms of atrial fibrillation (Author's Certificate No. 37325 dated 06/20/2023) allows determining the type of intervention and drug therapy regimen for each specific patient (i.e., personalized) taking into account objective medical data and patient characteristics.

Practical recommendations

1. To optimize the prevention of atrial fibrillation recurrence, a thorough assessment of recurrence risk factors should be conducted in the preoperative period (such as left atrial size, AF duration, concomitant cardiovascular diseases, posterior left atrial wall thickness, etc.) and considered when selecting catheter ablation methods.

2. To obtain reliable data on the long-term efficacy of various catheter ablation techniques, especially in patients with a high risk of AF recurrence, the use of implantable long-term ECG monitoring devices (REVEAL XT) in clinical practice is recommended. These devices will facilitate timely decision-making and help determine further treatment strategies.

3. The developed algorithm for interventional and surgical treatment of persistent and long-standing persistent forms of atrial fibrillation (Patent No. 37325 dated June 20, 2023) is applicable in clinical practice. It enables cardiologists to

diagnose AF in a timely manner, determine treatment tactics, and improve secondary prevention and prognosis for cardioembolic stroke.

4. The established database of patients with paroxysmal and persistent atrial fibrillation, who have implanted long-term ECG monitoring devices (REVEAL XT), serves as the foundation for creating a national registry of AF patients after catheter ablation. This will allow for further prospective monitoring and analysis of the efficacy of different catheter ablation techniques**.**

Approbation of the Research

The findings and key points of the dissertation were presented at the following events:

- International Congress "Cardiostim," February 27–29, 2020, St. Petersburg, Russia;
- VII Congress of Surgeons of Kazakhstan with International Participation "Surgery: Yesterday, Today, Tomorrow," dedicated to the 75th anniversary of the A.N. Syzganov National Scientific Center of Surgery, September 30-October 1, 2021, Almaty, Kazakhstan;
- 1st International Forum "Asfen.Forum, new generation - 2023", June 5-6, 2023, Almaty, Kazakhstan;
- VII International Congress dedicated to A.F. Samoylov "Fundamental and Clinical Electrophysiology. Current Issues in Medicine," April 5–6, 2024, Kazan, Russia;

Publications on the topic of the dissertation

Based on the dissertation materials, 12 papers have been published, including 1 article in publications recommended by the Committee for Quality Assurance in Science and Higher Education of the Ministry of Science and Higher Education of the Republic of Kazakhstan, 3 articles in foreign peer-reviewed publications indexed in the Scopus and Web of Science databases: "The Heart Surgery Forum" (percentile 40%, Q3, CiteScore - 1.2, impact factor 0.6), American Journal of Cardiology (percentile 60%, Q2, CiteScore – 4, impact factor 2.8), Journal of Cardiovascular Electrophysiology (percentile 71%, Q2, CiteScore - 5.2, impact factor 2.3), 7 abstracts in the materials of international scientific conferences and congresses, one Copyright certificate for a work of science No.37325 on June 20, 2023 RK.

Volume and structure of the dissertation

The dissertation is presented on 128 pages. It consists of an introduction, 4 chapters (a literary review, materials and research methods, the results of their own research, discussion and evaluation of their own results), conclusions, conclusions, practical recommendations, a list of sources used, 4 appendices. The text contains 18 tables and 34 figures. The list of references includes 289 sources.