RADIOFREQUENCY CATHETER ABLATION FOR CARDIAC ARRHYTHMIAS IN LITHUANIA: THE INCIDENCE AND TRENDS

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Summary
Radiofrequency ablation (RFA) is minimally invasive treatment based on thermal tissue destruction. Having reviewed the application of RFA method in a global context, we can state that it is widely used modern procedure in many economically developed countries. In many cases, RFA is qualified as effective, safe and economically profitable. There is a wide spectrum of clinical applications of RFA that cover diverse fields of medicine. RFA application in cardiology has become markedly significant. In 1976, RFA was introduced into clinical practice as an innovative management of cardiac arrhythmias. The development of nonsurgical minimally invasive cardiac arrhythmias treatment by radiofrequency catheter ablation (RFCA) procedure is greatly associated with evolution of cardiac surgery in general and the establishment of cardiac centers. Era of Lithuanian cardiac surgery had begun in 1960’s, when the first cardiac center in Lithuania was established. Currently, three cardiac centers are functioning in Lithuania. Arrhythmias treatment by RFCA was introduced into Lithuanian clinical practice in the mentioned cardiac centers where it is performed only there up to now.

Regarding the incidence of performed RFCAs for the arrhythmias (total of 3942 RFCAs over the five-year period between 2007 and 2011), this treatment method can be defined as a routine procedure in the cardiac centers of Lithuania. There was showed an upward trend in the number of performed RFCA procedures for arrhythmias over the last quinquennium in Lithuania, as the performance has grown by 3.75% for five consecutive years from 2007 and 2011, suggesting that this treatment method may become more and more popular in the future clinical practice.

Introduction
Radiofrequency catheter ablation (RFCA) is minimally invasive treatment for the cardiac arrhythmias, based on thermal destruction of certain sites in the myocardium that trigger arrhythmia. Typically, living tissue will be permanently destroyed at temperatures of approximately 45° to 50° C sustained for several seconds [21]. Thus, arrhythmogenic sites after their ablation are obliterated.
Radiofrequency ablation (RFA) launched in late 1960s. The first RFA was performed with the intention of causing therapeutic lesions in the neural tissue. In 1967 Dr. Sealey and his colleagues successfully ablated a right free wall atrio-ventricular accessory pathway in a fisherman with Wolff-Parkinson-White syndrome and recurrent tachycardia, at Duke University Medical Center [22]. Since then many institutions and surgeons made efforts to find reliable surgical techniques for all varieties of cardiac arrhythmias. Supraventricular tachycardias surgery is now well known and WPW syndrome is the best model. Ablation of the accessory pathway prevents atrioventricular reentrant tachycardia and atrial fibrillation with rapid ventricular response rate (this is the shortest RR interval due to AV conduction through an accessory pathway <250 msec). The accessory pathway is a congenital myocardial bundle coursing anywhere across the coronary sulcus, from most superficial epicardium to fat pad strictly close to annular layer. The accessory pathway can be surgically ablated using either endocardial or epicardial approach [23]. Any accessory pathway, correctly localized, can be ablated with high efficacy and low surgical risk, as shown by large series of Duke Univ., St. Louis Univ. and Kanazawa Univ [24].

In 1979, the first catheter ablation was performed coincidentally when Fontaine et al. observed a complete AV block in a patient undergoing defibrillation while one defibrillator electrode was in electrical contact with a catheter electrode positioned at the bundle of His [25]. Since then cardiac ablation became a nonsurgical procedure that uses a thin bendable wire called a therapeutic catheter. This catheter is placed through a patient’s vein and into the heart where the electrical impulses of the heart can be studied and treated. Among many modern, comprehensive, RFA techniques for treating arrhythmias an expection is Cox Maze method. It is minimally invasive surgical treatment involving radiofrequency ablation. In 1987 James L. Cox proposed the modified procedure of radiofrequency maze (Cox-Maze) in which by incision the maze is created in the atria. The maze procedure is widely recognized as an effective surgical method for treatment of the atrial fibrillation [14]. This technique effectively prevents (up to 90%) atrial fibrillation caused by the different mechanisms. Over the past decade during the maze procedure the conduction blockade incisions in the atria are performed using radiofrequency ablation method [15, 16]. In the early 80’s high voltage direct current ablation was further developed by Gallagher and Scheinman and used as a therapeutic approach to treat supraventricular tachycardias [26,27]. Although highly effective, direct current ablation was accompanied by severe complications such as cardiac tamponade, hypotension following shock delivery and the induction of ventricular arrhythmias, which stimulated the search for alternative energy sources. Huang et al. investigated in 1987 experimentally the use of radiofrequency energy for catheter ablation [28], followed by the first AV-node ablation by Budde et al [29] and the interruption of an accessory pathway by Borggreffe et al [30]. Around the year 1990 the RFA was applied for a routine treatment of cardiac arrhythmias [1, 2, 3]. Radiofrequency catheter ablation (RFCA) procedure is performed in a quite non-sophisticated manner as the energy required for the thermal destruction is easily delivered via an ablative catheter towards the certain site of the myocardium. The necessary equipment is relatively simple and inexpensive. As treatment effectiveness is high, this method has immediately become widely used. For example, more than 16 000 RFCA procedures were performed for elderly people in the United States in 1998 [4]. RFCA had undergone a rapid evolution over the last decades. The very initial attempts to perform RFCA were only partly successful and had relatively high complications rate. The rise of focal ablation with wide area isolation has made a revolution leading to an improved and modified RFCA procedure. The RFCA procedure had developed into highly individualised treatment capable to fight against a lot of diverse diseases. It has been performed a great number of RFCAs for various types of arrhythmias since 2008 in Lithuania, including radical atrial fibrillation RFCA, atrial tachycardia RFCA, ventricular extrasystole RFCA, atrial flutter RFCA, atrioventricular node reciprocating tachycardia RFCA, accessory pathways RFCA.

In Lithuania, the outset of nonsurgical minimally invasive treatment for cardiac arrhythmias by RFCA has been greatly associated with evolution of overall cardiac surgery and the establishment of cardiac surgery centers. Era of Lithuanian cardiac surgery had begun in 1960’s, when the first cardiac surgery center in Lithuania was established. In spite of the fact that Lithuania has a relatively small population, what comes to cardiac pathologies, it is not hesitated to use minimally invasive surgical as well as nonsurgical techniques for their treating. The RFCA is widely used to treat diverse types of cardiac arrhythmias here. As it was mentioned before, the RFCA is performed only in specialist cardiac centres in Lithuania.

The first cardiac centre was launched in Vilnius. Afterward, another cardiac centre was established in the second largest city Kaunas. A great variety of cardiac surgery techniques have been performed at these centres, including surgical treatment of coronary heart disease applying atrio-caval shunt (1971) and other advanced cardiac...
surgery. Back then the cardiac centre in Kaunas had a huge amount of the accumulated experience in tachyarrhythmia therapy. The third Lithuanian cardiac centre was founded in Klaipeda Seamen’s Hospital in May 1994 [13]. Nowadays, these cardiac centres widely perform radiofrequency ablation procedures for the diverse variety of cardiac arrhythmias.

Object of study - The incidence of radiofrequency catheter ablation for the management of the patients with cardiac arrhythmias over the five consecutive years from 2007 and 2011 in Lithuania.

Aim of study - (1) to determine the incidence of radiofrequency catheter ablation procedure for the management of the patients with cardiac arrhythmias from 2007 to 2011, (2) to evaluate the different types of cardiac arrhythmias treated by radiofrequency ablation and assess the trends of this treatment method in the context of Lithuanian clinical practice.

Object of study and methods

The study was performed in a retrospective manner. We analyzed databases of Lithuanian cardiac centers (pertaining to three major hospitals): Vilnius Cardiac Surgery Center (VCSC), Kaunas Cardiac Surgery Center (KCSC) and Klaipeda Seamen’s Hospital Cardiac Surgery Center (KSHCSC). The data included records related to the radiofrequency catheter ablation chosen as the treatment method for the patients having cardiac arrhythmias, including five consecutive years from 2007 to 2011. Analysis of the relevant data was performed using Microsoft Office Excel 2007.

Fig. 1. Five-year incidence of RFCA for cardiac arrhythmias in Lithuania

Fig. 2. Five-year incidence of RFCA for cardiac arrhythmias by different cardiac surgery centers in Lithuania

Fig. 3. Distribution of RFCA for arrhythmias by cardiac surgery center in Lithuania: from 2007 to 2011

Fig. 4. Distribution of different types of arrhythmias treated by RFCA in Vilnius Cardiac Surgery Center: covering the five-year period between 2007 and 2011

Fig. 5. Distribution of RFCAs for different types of arrhythmias performed in Kaunas Cardiac Surgery Center, covering the five-year period between 2007 and 2011
Results and discussion

The incidence of RFCA for cardiac arrhythmias performed in Lithuanian cardiac surgery centers. It is presented in a chart (Fig. 1). A total of 3942 RFCA procedures for the arrhythmias were performed between 2007 and 2011. There was a climb from 771 RFCA procedures in 2007 to 803 RFCA procedures in 2010 before its gentle fall, reaching 801 RFCA procedures in 2011. Performance of RFCA for the arrhythmias showed an upward trend growing by 3.89% for five consecutive years from 2007 and 2011 in Lithuania.

Quantitative distribution of RFCA procedures for the arrhythmias performed by three different cardiac centres in Lithuania. It is presented in a chart (Fig. 2). From 2007 to 2011, there were performed 1168 RFCA procedures in VCSC, 2120 in Kaunas Cardiac Surgery Center (KCSC), and 654 in KSHCSC. In total, 3942 RFCA procedures were carried out in Lithuania during the year 2007 to 2011. Over the five-year period between 2007 and 2011, the incidence of performed RFCA procedures has grown by 19.79% in KCSC and by 4.58% in VCSC (by 13.94% in both KCSC and Vilnius Cardiac Surgery Center put together), however, the growth rate reduced by 38.78% in KSHCSC, showing some fluctuation and hitting the lowest point of 90 in 2011 over the period between 2007 and 2011. Overall, performance of RFCA for the arrhythmias showed an upward trend for five consecutive years from 2007 and 2011 in Lithuania.

The distribution of RFCA for arrhythmias by cardiac surgery center from 2007 to 2011. It is presented in a pie chart (Fig. 3). It shows that 54% of all RFCA procedures was performed in KCSC.

The distribution of different types of cardiac arrhythmias treated by RFCA in VCSC over the period between 2007 and 2011. It is presented in a pie chart (Fig. 4). They include atrial fibrillation - 87 patients, atrial flutter - 328 patients, atrioventricular nodal re-entrant tachycardia (AVNRT) - 320 patients, Wolf-Parkinson-White (WPW) syndrome - 244 patients, and idiopathic ventricular tachycardia - 82 patients; making up 90.84% of total number of RFCA procedures for arrhythmias performed in VCSC between 2007 and 2011. It is seen that dominant pathologies are atrial flutter, AV nodal re-entrant tachycardia, and Wolf-Parkinson-White syndrome accounting for 76%, put together.

The number of RFCA procedures for diverse types of the arrhythmia performed in KCSC between 2007 and 2011. It is presented in an area chart (Fig. 5). In the year 2007 the major part of the pathologies treated by RFCA included ventricular extrasystole, atrial flutter, atrioventricular node reciprocating tachycardia and accessory pathways. RFCA for radical atrial fibrillation and atrial tachycardia have been started to perform since 2008. Both of them accounted for 10.2% of total RFCA procedures performed in 2008.

Distribution of RFCA procedures for treated arrhythmias in KCSC over the period between 2007 and 2011. It is presented in the previous chart (Fig. 1). The chart shows that percentage of different types of arrhythmias treated by RFCA in KCSC has remained fairly steady until 2011, as the greatest number of RFCA procedures has been performed for treating ventricular extrasystole, atrial flutter and atrioventricular node reciprocating tachycardia, making up not less than 67% of the RFCA procedures annually.

The Cox maze procedure. The Cox maze procedure with adjusted correction of mitral valve disease has been performed since 2000 in Vilnius Cardiac Surgery Center. Between 2001 and 2003, 36 patients have undergone surgical correction of mitral valve, along with a modified maiz procedure [17]. Cox node procedure was carried out in 14 men and 22 women. The average age of all patients was 55.17 ± 10.5 years, mean duration of atrial fibrillation was 59.4 ± 50.6 months. In all 36 patients (100%) immediately after the surgery there was no atrial fibrillation or atrial flutter. [17]. This shows the great success rates and proves that RFCA for cardiac arrhythmias such as atrial fibrillation is an effective treatment significantly improving an overall cardiac patients health and upgrading their quality of life.

Conclusions

Having reviewed historical aspects and current practice of the radiofrequency catheter ablation (RFCA) for cardiac arrhythmias in Lithuanian cardiac surgery, it can be stated that over the last decades therapeutic procedures, methodology have been rapidly developing, the cardiovascular disease nomenclature, instruments involved in surgical and nonsurgical minimally invasive manipulation tools have been improving. The treatment of various arrhythmias by RFCA has a long-term tradition in Lithuanian cardiac centres. Three cardiac centres had been established since 1960s in Lithuania. In these centers RFCA has been performed on patients with varying degrees of complexity of cardiac rhythm disorders. This method of arrhythmias treatment is performed there up to now.

RFCA has become an efficient and accessible minimally invasive nonsurgical procedure. Over the recent years in Lithuanian clinical routine the RFCA was proven to be effective, safe and minimally traumatising to the patient, also, easily carrying out and having a low economical cost. Regarding the incidence of performed RFCA procedures for the arrhythmias (total of 3942 RFCA procedures over the five-year period between 2007 and 2011), this treatment method can
be defined as a routine procedure in the cardiac centers of Lithuania.

Despite the trivial rates of risks and complications, associated with the procedure, RFCA can be undertaken in children and adolescents with a high success rate, few recurrences and complications, very short procedure times, and acceptable fluoroscopy times [20]. Because of these advantages, Lithuania has been keeping pace with developed countries in the performance of RFCAs for cardiac arrhythmias. As the performance of the RFCA for the arrhythmias has been showing an upward trend growing by 3.75% for five consecutive years from 2007 and 2011 in Lithuania, it is presumptive the incidence of the RFCA in Lithuanian cardiac surgery will be gradually increasing in the future.

References

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ARITMIŲ GYDYMAS RADIODAŽNINE ABLIACIJA LIETUVOJE: ŠIUOLAIKINĖ PRAKTIKA IR ATEITIES TENDENCIOS

Raktas
Širdies ritmo sutrikimai, minimaliai invazyvus aritmijų gydymas, širdies chirurgija, radiodažnuminė kaketerizacinė abliacija, radiodažnuminė abliacija.

Santrauka


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