Srce i krvni sudovi 2023; 42(4): 96-99

Original article

15 Years of Zajecar Paceaker Center

Aleksandar Jolić[1], Vladimir Mitov[1], Tomislav Kostić[2], Dragana Adamović[1], Milan Nikolić[1], Marko Dimitrijević[1]

[1]Pacemaker center, Invasive Cardiology Department, Zajecar Health Center, [2]Pacemaker center, Cardiology Clinic, Clinical Center Nis,

Abstract The aim of this study is to present the results of the Pacemaker Center in Zaječar from 2008 to 2023. The analysis included 1849 patients with implanted CIED (Cardiac Implantable Electronic Device) with an average age of 73.30±1.16, comprising 1154 (62%) males and 696 (38%) females. There were 753 (36.35%) VVI, 964 (46.61%) DDD, 19 (1%) VDD, 26 (3.03%) ICD, and 16 (1%) CRT-P implants. Among the procedures, 234 (11.01%) were pulse generator replacements, while the rest were primary implants. Analysis of indications for CIED implantation revealed that 45.29% of patients had AV node disease, 23.24% had SA node disease, and 31.14% had atrial fibrillation with slow ventricular rate as the indication. The average duration of the intervention was 40.68 minutes, and the fluoroscopy time was 4.67 minutes. Conclusions: From 2008 to 2023, a total of 1849 implantations of various types of cardiac implantable electronic devices were performed. The number of implantations has been on consistent rise, with over one hundred procedures annually since 2010 and exceeding 150 implantations per year after 2019, reaching approximately 450 per million inhabitants. This is in line with the national and European averages for Eastern European countries.

Key words pacemakers, Zajecar Health Center

Introduction

The therapy with implantable electronic devices, known as Cardiac Implantable Electronic Devices (CIED), began its development in the 1950s as a method of implanting then-bulky and exclusively pulse generator devices for treating patients with severe bradycardic conduction disorders. These procedures were performed by highly trained and then and now still rare vascular and cardiothoracic surgeons. The development of this branch of medicine progressed rapidly alongside technological advancements, leading to today's devices that serve numerous therapeutic roles in both bradycardic and tachycardic heart rhythm and conduction disorders. They also play a crucial role in heart failure therapy and monitoring patients through various electrical and other parameters[1].

All CIED's can be broadly categorized into therapeutic-diagnostic and diagnostic devices. The first group includes devices for treating bradycardic and tachycardic disorders, as well as devices for heart failure therapy. In the group for treating bradycardic rhythm and conduction disorders, there are single-chamber (VVI), dual-chamber (DDD), and pacemaker with so called single pass electrodes (VDD) pacemakers. For treating tachycardic disorders, there are implantable cardioverter-defibrillators, both single-chamber (ICD VR), dual-chamber (ICD DR), and resynchronizers with defibrillator function (CRT-D). Devices for heart failure therapy include resynchronizers with pacemaker function (CRT-P) and those mentioned earlier with an added defibrillator function, as well as newer generation devices still in the development and research phase (baroreceptor stimulators, vagal stimulators).

To explain the type of device, it is necessary to briefly explain the international code table of pacemakers with corresponding letter groups in the code: 1. The first letter represents the stimulation site (V-ventricle, D-dual), 2. The second letter represents the site for registering electrical activity of the heart (V-ventricle, D-dual, O-no registration), 3. The third letter represents the reaction to the registered activity (I-Inhibition, D-dual, T-trigger, O-no response), and 4. The fourth letter represents the option for rate adaptability (R rate response) or none if not applicable.

Devices for monitoring include implantable loop recorders (ILR), which have the capability of directly monitoring various rhythm and conduction disorders. Today, they also have various telemetry options for sending collected data, allowing for almost instant alerting of doctors about significant events monitored in patients. The aim of this study is to present the results of the Pacemaker Center in Zaječar from 2008 to 2023.

Methods

In this study, an electronic database of patients with Cardiac Implantable Electronic Devices (CIED) from the

Address for correspondence: Alaksandar Jolic, MD; , Invasive Cardiology Department, Zajecar Health Center; Mail: jolical149@gmail.com

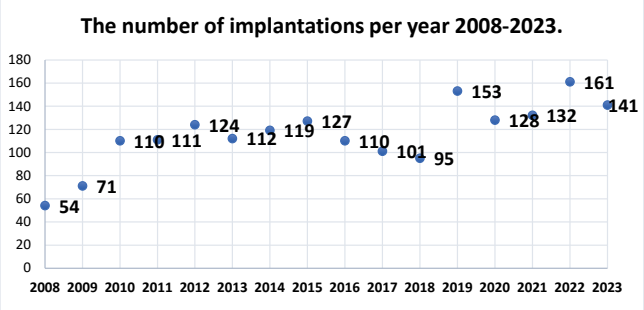

Figure 1. Number of implantations per year from 2008 to 2023

Out of the total number, 753 (36.35%) were VVI, 964 (46.61%) were DDD, 19 (1%) were VDD, 26 (3.03%) were ICD, and 16 (1%) were CRT-P (Graph 2). ICD implantations started in 2013, and CRT-P implantations began in 2018 (Graph 3).

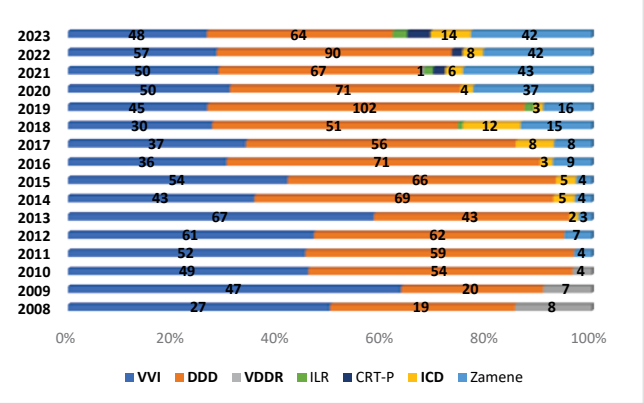

Figure 3. Types of pacemakers by year

Analysis of the indications for which CIEDs were implanted found that 45.29% of patients had AV node disease, 23.24% had SA node disease, while in 31.14% of cases, the indication was atrial fibrillation with slow ventricular rate (Graph 4 and 5).

Pacemaker Center in Zaječar, now part of the invasive cardiology department, was used. A retrospective analysis of data on the implantation of these devices was conducted for the period from 2008 to 2023. The analysis covered 1849 patients with implanted CIED, with an average age of 73.30±1.16, including 1154 (62%) males and 696 (38%) females. The implanted devices included 753 (36%) VVI, 964 (47%) DDD, 19 (1%) VDD, 26 (3%) ICD, and 16 (1%) CRT-P. There were 234 (11%) pulse generator replacements, while the remaining procedures were primary implantations.

Pacemaker implantations were performed in the Cath lab. Throughout the intervention, the patient's cardiac activity was monitored on the defibrillator monitor and since 2014, with the initiation of the new Cath lab, hemodynamics was monitored on the Cath lab hemodynamics monitor. The implantation was carried out by a trained team consisting of an operating physician, a medical technician-instrumentalist, and cardiovascular medical technicians (trained to work as instrumentals, in aseptic conditions, and to perform cardiopulmonary cerebral resuscitation). During the operation, the patient lies on their back. The operative field was prepared by disinfecting and isolating the field with sterile compresses, adhering to surgical principles of asepsis and antisepsis. Local infiltrative anesthesia was used, with a combination of Lidocaine, Bupivacaine, and bicarbonate. The implantation of the permanent antibradicardiac pacemaker was conducted using classical surgical techniques in the right pectoral region. An incision was made in the deltopectoral sulcus, approximately 5cm in length, starting 2cm below the clavicle. The cefalic vein was prepared as the primary vascular access. In cases where preparing the cefalic vein with adequate lumen and flow was not possible, the alternative approach involved puncturing the subclavian vein or axillary vein under the guidance of fluoroscopy in postero-anterior or 30-degree caudal projection, with or without venography (contrast application in the ipsilateral venous system) using the modified Seldinger technique. Electrodes were placed in the right cardiac chambers via the prepared or punctured vein. Electrode positioning was conducted under fluoroscopy control. The ventricular electrode was placed with passive fixation at the apex of the right ventricle or with active fixation, using a screw-in system, in the outflow tract of the right ventricle[2].

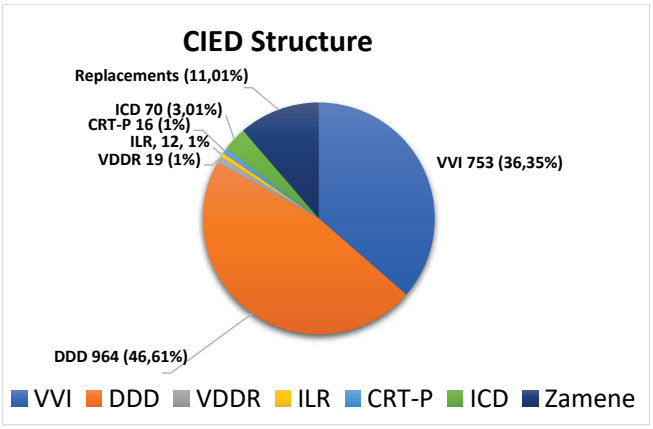

Figure 2. CIED structure from 2008-2023

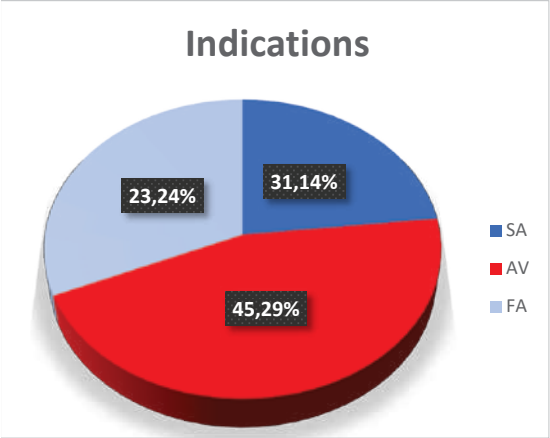

Figure 4. Indications in the total number

Results

In this time period, a total of 1849 CIED implantations were performed. Only in 2008, 2009, and 2018 were there fewer than 100 implantations annually; the data for 2023 is not fully presented (Graph 1).

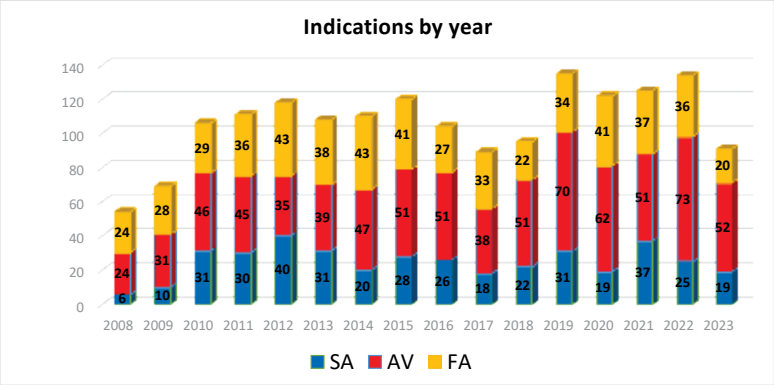

Figure 5. Indications by year

The average duration of the intervention was 44.93±6.38 minutes, and the fluoroscopy time was 5.37±2.24 minutes. Over the years, the longest average time was in 2008, with 54.35 minutes, and the shortest was in 2021, with 32.2 minutes. The average fluoroscopy time ranged from 3.14 minutes in 2010 to 12.8 minutes in 2020 (Graph 6).

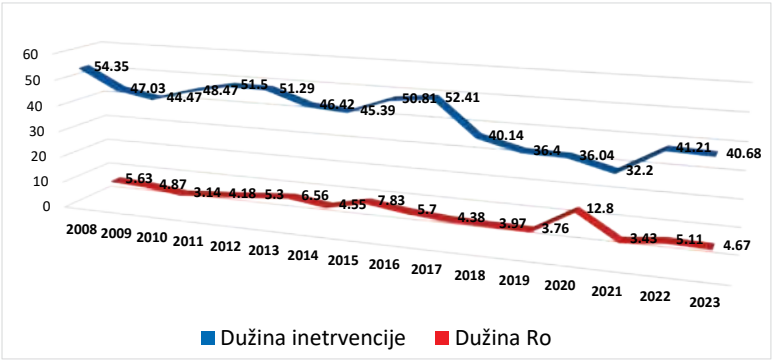

Figure 6. Total and fluoroscopy times from 2008 to 2023

Discussion

The Pacemaker Center in Zaječar began its operations in 2006, initially focusing on the implantation of temporary pacemaker electrodes as a life-saving measure until the patient could undergo permanent pacemaker implantation or until the resolution of the disorder. The era of permanent CIED implantation, including single-chamber pacemakers and VDDR pacemakers, commenced in 2008, followed by the implantation of dual-chamber pacemakers a month later. The implantation of single-chamber cardioverter-defibrillators started in 2013. From 2018 onwards, resynchronization CIED implantations began, completing the range of current devices. It's noteworthy to mention our center's participation in a study involving vagal stimulators as the next step in heart failure electrotherapy.

In recent years, there has been an increase in the number of pacemaker implantations. This is attributed to improved diagnostics, better education of medical professionals, and the overall increase in life expectancy in the general population. In Serbia, the number of implantations has also been on the rise, reaching 435 per million inhabitants or 3186 pacemakers in 2010 and 521 per million inhabitants or 3724 implantations in 2015. The number of implantations in our center is in line with the our national average, with 440 implantations per million inhabitants in 2010 and 508 implantations per million inhabitants in 2015. This is significantly better than Moldova with 79 implantations per million inhabitants but still far from Belgium, which had 1218 implantations per million inhabitants[3,4,5]. In our setting, the most common indication was AV node disease in 45.29% of patients, followed by atrial fibrillation in 31.14% of patients. This distribution of indications is expected given the average age of patients, which was 73.30 years[6]. As a result, the smallest number of patients, 23.24%, had SA node diseases, which are more common in younger age groups. Since SA and AV node diseases were the most prevalent, DDD and VDD pacemakers were also proportionally more prevalent at 47.61% compared to VVI at 36.35%. The average total time of implantations was 40.68 minutes, and the average fluoroscopy time was 4.67 minutes, with a trend showing a gradual decrease in intervention and fluoroscopy time each year.

Conclusion

During the period from 2008 to 2023, a total of 1849 implantations of all types of implantable cardiac electrical devices were performed. The number of implantations has been consistently on the rise, with over one hundred procedures annually since 2010 and exceeding 150 implantations per year after 2019, reaching approximately 450 per million inhabitants. This is in line with the national and European averages for Eastern European countries.

References

1. Mitov V, Perisić Z, Jolić A, etaal. The effect of right ventricle pacemaker lead position on diastolic function in patients with preserved left ventricle ejection fraction. Hell J Nucl Med 2013; 16(3):204–208.
2. Burri H, Starck C, Auricchio A, et al. EHRA expert consensus statement and practical guide on optimal implantation technique for conventional pacemakers and implantable cardioverter-defibrillators: endorsed by the Heart Rhythm Society (HRS), the Asia Pacific Heart Rhythm Society (APHRS), and the Latin-American Heart Rhythm Society (LAHRS). EP Eur 2021;23(7):983–1008.
3. Torbica A, Banks H, Valzania C, et al. Investigating regional variation of cardiac implantable electrical device implant rates in European Healthcare Systems: What drives differences? Health Econ 2017;26 Suppl 1:30–45.
4. Raatikainen MJP, Arnar DO, Zeppenfeld K, et al. Statistics on the use of cardiac electronic devices and electrophysiological procedures in the European Society of Cardiology countries: 2014 report from the European Heart Rhythm Association. Eur Eur Pacing Arrhythm Card Electrophysiol J Work Groups Card Pacing Arrhythm Card Cell Electrophysiol Eur Soc Cardiol 2015;17 Suppl 1:i1-75.
5. Raatikainen MJP, Arnar DO, Merkely B, et al. A decade of information on the use of cardiac implantable electronic devices and interventional electrophysiological procedures in the European Society of Cardiology Countries: 2017 report from the European Heart Rhythm Association. EP Eur 2017;19(suppl_2):ii1–90.
6. EHRA WHITE BOOK [Internet]. Available at: http://www.ehra-whitebook-analysis.com/

Sažetak

15 godina pejsmejker centra u Zaječaru

Aleksandar Jolić[1], Vladimir Mitov[1], Tomislav Kostić[2], Dragana Adamović[1], Milan Nikolić[1], Marko Dimitrijević[1]

[1]Pejsmejker Centar, Odeljenje invazivne kardiologije Zdravstevni Centar Zaječar, [2]Pejsmejker Centar, Klinika za Kardiologiju, Klinički Centar Niš

Cilj rada je prikaz rezultata rada Pejsmejker centra u Zaječaru u periodu od 2008-2023. godine. Analizom je obuhvaćeno 1849 pacijenata sa implantiranim CIED-om prosečne starosti 73.30±1.16, od kojih je bilo 1154 (62%) muškaraca 696 (38%) žena. Bilo je implantirano 753 (36,35%) VVI, 964 (46,61%) DDD, 19 (1%) VDD i 26 (3,03%) ICD, i 16 (1%) CRT-P. Bilo je 234 (11,01%) zamena pulsnog generatora dok su ostale operacije bile primoimplantacije. Analizom indikacija zog kojih su implantirani CIED nađeno je da je 45,29% pacijenta imalo bolest AV čvora, 23,24% bolest SA čvora, dok je kod 31,14% razlog bila atrijalna fibrilacija sa sporom komorskom frekvencom. Prosečna dužina intervencije bila je 40,68 minuta, dužina rendgen skopije bila je 4,67 minuta.

***Zaključci:** U periodu rada od 2008 do 2023. bilo je 1849 implantacija svih tipova implantabilnih srčanih električnih uređaja. Broj implantacija je u konstatnom porastu, tako da od 2010. godišnje je bilo više od sto implantacija a nakon 2019. preko 150 implantacija ili oko 450 na milion stanovnika, što je u rangu nacionalnog i evropskog proseka za zemlje istočne Evrope.*

***Ključne reči**: pejsmejkeri, Zdravstveni centar Zaječar*