

# Continuity of cardiac care in patients after implantation of cardiac implantable electronic devices

## Ciągłość opieki kardiologicznej u pacjentów po implantacji urządzenia do elektroterapii serca

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Marcin Madziarski jest świeżo upieczonym absolwentem kierunku lekarskiego na Wydziale Lekarskim Uniwersytetu Medycznego im. Piastów Śląskich we Wrocławiu. Od lat zaangażowany członek Zarządu Koła Kardiologicznego Uniwersyteckiego Szpitala Klinicznego im. Jana Mikulicza-Radeckiego we Wrocławiu, brał udział w licznych konferencjach o tematyce chorób serca. W 2015 roku ukończył Politechnikę Wrocławską i od tego czasu interesuje się wykorzystaniem nowoczesnych technologii w medycynie, od 2016 roku pracuje w zespole medyczno-informatycznym nad stworzeniem aplikacji ułatwiającej postawienie właściwej diagnozy na odległość. Aktywnie działa także w Klubie Sportowym Uczelni, organizując wyjazdy dla studentów. W wolnym czasie uprawia crossfit i gra w squasha.

### Abstract

**Introduction.** Cardiac care continuum is an important factor affecting the treatment of patients after implantation of cardiac support devices. The aim of this paper was to assess the factors influencing compliance among 179 (67 women / 112 men, aged  $76.7 \pm 8.6$  years) randomly selected patients with implanted electrotherapy devices.

**Material and methods.** This was a retrospective and open study. Required data were obtained from patients' medical history and questionnaires completed during follow-up visits and from patients' medical records.

**Results.** It was shown that men were more likely to attend follow-up visits than women ( $p = 0.002$ ), residents of large towns (over 100.000 population) more likely than residents of smaller towns ( $p = 0.02$ ), patients under 65 years of age ( $p < 0.05$ ) more likely than older patients and self-sufficient patients more likely than those needing others' assistance ( $p < 0.05$ ).

Patients living closer to the clinic (distance up to 50 km) and regularly taking medicines were not more compliant with their scheduled cardiology visits.

**Conclusions.** There are some factors associated with insufficient cooperation in the continuity of cardiac care in patients after implantation of cardiac support devices. Individual approach to patients who are non-compliant may be helpful in changing individual behaviors, which will result in treatment compliance.

Key words: cardiac electrotherapy, electrophysiology, cardiac stimulation device, regular visits, compliance

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## Introduction

The incidence of cardiovascular disease and the number of years of potential life lost due to the most common cardiac illnesses give priority to the prevention, diagnosis and treatment of diseases in this group [1]. In recent years, significant improvements have been observed in both the care funding and the availability of one of the cardiology fields – interventional cardiology [2]. There has been a marked improvement in the treatment of life threatening conditions. There has also been an increase in public awareness of cardiovascular diseases. Cardiac arrhythmias and congestive heart failure pose important cardiac complications. Knowledge of these serious medical conditions is still insufficiently distributed in the society [3]. These diseases often require the use of medical procedures, commonly referred to as electrophysiology, involving two areas of cardiology: implantation of cardiac implantable electronic devices and arrhythmia management.

The analysis of the articles of various authors [4-6] shows, that cardiovascular care is an important factor, which influences the correct course of treatment of cardiac arrhythmias, conduction disorders and heart failure in patients, who underwent implantation. Patients' involvement in the treatment process and their following the medical advice, regarding frequent control visits, are complex problems that occur in every field of medicine.

Insufficient and ineffective patient cooperation in terms of adherence to medical advice is emphasised in many articles, but there is a total lack of the underlying cause of this phenomenon in the Polish literature.

## Aim

The purpose of the study was to find out whether age, sex, comorbidity, patient's residence (village/city), the degree of autonomy and continued medication were factors determining the continuity of cardiac care in patients after implantation of cardiac implantable electronic devices.

## Materials and Methods

The study was retrospective and open. The data were based on the medical history collected during an ongoing monitoring of 179 patients after implantation of cardiac implantable electronic devices in the Department of Cardiology at Wrocław Medical University Hospital and an analysis of the patients' medical records. All the data were being collected within half-year period from 10.2014 to 03.2015 and every patient, who agreed with the terms of this study, was included and then assigned to one of two groups – patients, who continued regular cardiac care, and patients who did not. The study also included medical records, which enabled the authors to evaluate the continuation of regular

cardiac care over past two years. Cardiac care continuation meant, that patients did not skip more than one planned medical appointment, which, on average, took place every three months. The exact date of the visit could be chosen by the patient, but the choice of an outpatient clinic, as a place of visit, could not be changed. None of patients were analysed telemetrically. The age, sex, type of an implanted device, date of first implantation, indication for surgery, frequency of cardiac control, distance from home to clinic and the degree of patient autonomy were analysed.

On 30 April 2015, the Bioethics Committee of the Medical University of Wrocław received the approval of KB – 205/2015. The data were developed using Microsoft Office Excel. Statistical analysis was performed using Statistica 12 program,  $p < 0.05$  was considered statistically significant. In the statistical calculations, the Chi-square test and the t-Student test were used. The characteristics of the analysed patients group are presented in Table 1.

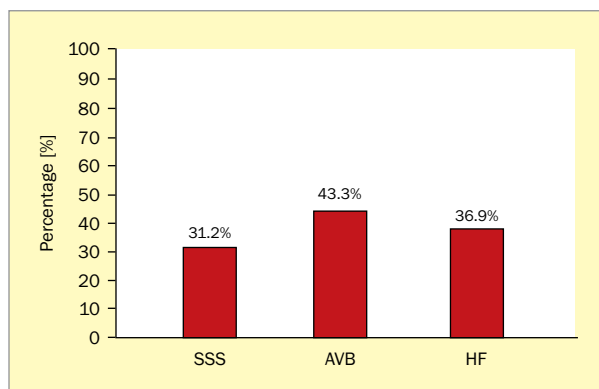
## Results

Characteristics of the analysed group of patients from the pacemaker out-patient clinic at Wrocław Medical University Hospital are presented in Table 1.

Figure 1 shows the reasons for implantation of pacing devices. Sinus node disease and heart failure were the most common reasons for implantation of cardiac implantable electronic devices. Some patients had been diagnosed with more than one disease, included in Figure 1. For the needs of the analysis, it was determined that the patients regularity in continuing cardiac care may depend on the exact disease, therefore many cardiac conditions

**Table 1.** Characteristic of the analysed group of patients from out-patient clinic in Clinical Hospital of Wrocław Medical University

Number of patients		n = 179
Age [years ]	mean	76,7
	SD	8,6
Distance between patient's house and Clinical Hospital [km]	mean distance	35
	Wrocław – city	54,2% (n=97)
	up to 50 km	18,4% (n=33)
	50–100 km	12,8% (n=23)
Place of residence	over 100 km	14,6% (n=26)
	city	82,1% (n=147)
	village	17,9% (n=32)
Degree of autonomy	self-sufficient	38% (n=68)
	coming to clinic with assistance	25,1% (n=45)
	disabled	3,4% (n=6)
	no information	33,7% (n=60)



**Figure 1.** Reasons of implantation of cardiac implantable electronic devices SSS – Sick Sinus Syndrome; AVB – Atrioventricular block; HF – Heart Failure

were detailed in the Figure. The authors emphasise, that the status after sudden cardiac arrest refers only to the patients who underwent ventricular fibrillation – ICD was implanted for secondary prevention of sudden cardiac death. The authors declare, that different groups of reasons for implantation in Figure 1 were depicted not to compare them with one another, but rather to specify the target group of patients.

A pacemaker was the most often implanted device among all the patients – 106 patients had this device (59%). ICD (implantable cardioverter) and CRT (cardiac resynchronisation therapy) were implanted in 66 (37%) and 7 (4%) patients, respectively. Due to the fact, that the vast majority of patients had narrow QRS complex, there were no indications to implement CRT devices, despite significant number of patients with heart failure. ICD was implanted in many patients with heart failure as an indication due to narrow QRS complex and low ejection fraction.

Table 2 compares the frequency of regular cardiac care continuation between two main groups of patients divided always into two different groups in terms of factors such as age, sex and other. P value is given to indicate statistically significant differences among the chosen groups.

**Table 2.** Frequency of continuation regular cardiac care among patients with implanted electrotherapy device according to selected parameters

Frequency of continuation regular cardiac care among group of:				p value
Patients in age below 65 years	67,5%	Patients in age over 65 years	50,5%	< 0,05
Males	65%	Females	37,5%	<0,05
Self-sufficient patients	62%	Dependent patients	48,5%	< 0,05
Patients taking medicaments continuously	52,5%	Patients not taking medicaments continuously	52%	> 0,05
Patients living in the city	57,5%	Patients living in a village	29,5%	<0,05
Patients having the distance to clinical hospital over 50 km	55%	Patients having the distance to clinical hospital up to 50 km	45%	> 0,05

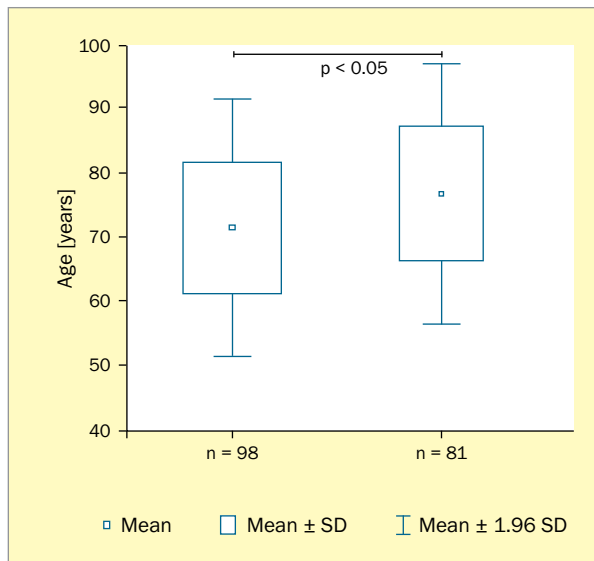
Male patients with implanted cardiac implantable electronic devices are significantly more likely to continue cardiac care than women ( $p = 0.002$ ). City dwellers (in cities over 100 thousand people) are more likely to continue cardiac care than residents of less populated areas ( $p = 0.02$ ). Patients under 65 years old are more likely to continue cardiac care than the elderly above this age (70% vs. 50%;  $p < 0.05$ ). Self-sufficient patients, referred to the out-patients clinic, were more likely to continue regular care than patients who needed assistance (62.7% vs 42,6%;  $p < 0.05$ ). There was no correlation between the distance from the patient's home to the clinical hospital and frequency of continuation regular cardiac care. Regular medication also did not have any influence on the continuation of cardiac care ( $p > 0,05$ ) (Table 2).

Statistical analysis showed, that the mean age of patients continuing cardiac care is significantly lower than in the group of patients who did not continue cardiac care (Figure 2). Overall, in the whole analysed group of patients, only 55% of them continued regular cardiac care.

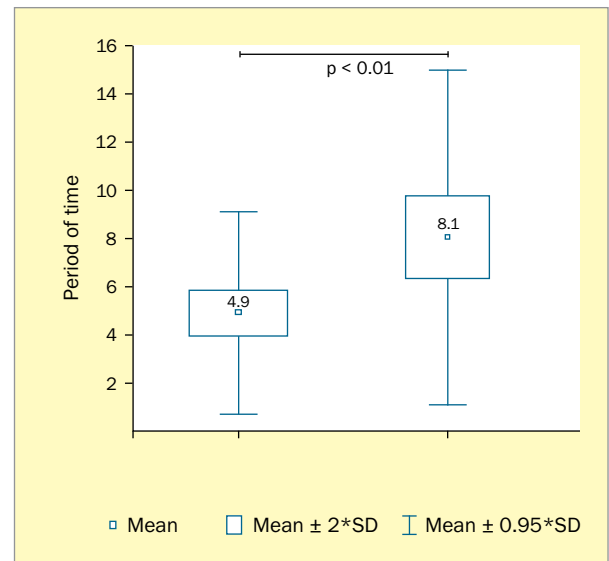
Statistical analysis (Figure 3) showed, that the mean period of time from the first implantation in the group of patients not continuing regular cardiac care was significantly longer than in the group of patients continuing regular care (4,9 years vs. 8,1 years;  $p < 0,01$ ).

## Discussion

A review of the literature indicates, that this study is the first one which analyses the problem of follow-up after device implantation in Polish patients. Most of the published studies [6–8] refer to the assessment of control frequencies and changes in the parameters of implanted devices. This study emphasises the social and economic problems, which may hinder regular and recommended visits in the pacemakers out-patient clinic at Wroclaw Medical University Hospital. Similar studies have been conducted in certain foreign centres [4–6, 12]. By analysing all the results, we can notice that only a small percentage of patients continued a proper follow-up after implantation of the pacing



**Figure 2.** Mean age and standard differentiations of patients continuing and not continuing regular cardiac care



**Figure 3.** The mean period of time from the first implantation of an electrotherapy device in patients continuing and not continuing regular cardiac care

devices. In Hess et al. Study [4] less than half of the patients came for scheduled visits, while in our study, more than 50% of the patients continued regular visits. Similar results showed by Al-Khatib et al. [6], who analysed almost 40.000 patients' medical histories from the US base Medicare, 50% of the patients came for scheduled first visit. Among those, who made a planned appointment, nearly 70% were patients over 65 years old [4], however, among the presented group of patients, they were only 50%. It is worth emphasising that there was no correlation between the distance from the patient's home to the pacemaker out-patient clinic at Wroclaw Medical University Hospital and adherence to recommendations, which would seem to be one of the most important difficulties in continuing regular cardiologists' visits. There are no other results in the literature about the impact on the distance from the laboratory, which makes the reference to the other studies impossible. In this study, males significantly more often continue systematic visits. However, other authors did not notice any gender differences [6]. To highlight how important systematic, planned follow-up visits of patients after implantation of devices for the stimulation of the heart are, it is worth to refer oneself to the study by Laksman et al. [5] with almost 9.000 patients after ICD implantation. The study showed an increased mortality among patients who did not come for the scheduled visit. Some other study, conducted by Hess's team et al. [4], showed a lower total mortality among patients who came for regular follow-up visits to those who did not accomplished them within one year after implantation of the device. In several studies, due to the strategy of remote monitoring of cardiac implantable electronic devices, it has been possible to safely reduce the

number of required follow-up visits [9-11]. Italian TARIFF study (Health Economics Evaluation Registry for Remote Follow-up) included 209 patients in two groups. Patients who were assigned to the first group came for the follow-up visits to the office every three months, while in the second group, examination in the third, sixth, ninth month was performed remotely. This resulted in more frequent actions in case of the second group to have been taken during in-person visits, which consequently affected the whole treatment. This also helped to reduce transportation costs, and more importantly, patients and accompanying people rarely left the workplace due to follow-up. It seems interesting to know, that in other studies, definitely more patients came with a companion 73% [12], 77% [11], compared with 28,5% in this study.

## Conclusions

Our results suggest, that there are factors, which influence the continuity of cardiac care in patients after implantation of cardiac implantable electronic devices.

Health centres might focus on the promotion of routine clinic follow-up among these particular groups to enhance the final compliance. Such approach could be helpful in changing individual behaviours and reducing the occurrence of noncompliant patients.

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**Conflict of interest**

The authors state no conflict of interest.

**Funding sources**

All the authors none declared.

**Streszczenie**

**Wstęp.** Istotnym czynnikiem wpływającym na prawidłowy przebieg leczenia u pacjentów po implantacji urządzeń wspomagających pracę serca jest zachowanie ciągłości opieki kardiologicznej. Celem pracy była ocena czynników wpływających na przestrzeganie zaleceń u 179 (67 kobiet/112 mężczyzn; wiek  $76,7 \pm 8,6$  lat) wybranych losowo pacjentów z implantowanymi urządzeniami do elektroterapii.

**Materiał i metody.** Badanie miało charakter retrospektywny i otwarty. Dane uzyskano na podstawie wywiadu lekarskiego i ankiet zebranych podczas bieżących kontroli pacjentów oraz analizę dokumentacji medycznej.

**Wyniki.** Wykazano, że istotnie częściej do kontroli kardiologicznej zgłaszali się mężczyźni niż kobiety ( $p = 0,002$ ), mieszkańcy większych miast (powyżej 100 000 ludności) w porównaniu z mieszkańcami mniejszych miejscowości ( $p = 0,02$ ), chorzy poniżej 65 roku życia ( $p < 0,05$ ) oraz pacjenci samodzielni ( $p < 0,05$ ).

Nie stwierdzono, aby pacjenci mieszkający bliżej poradni (odległość do 50 km) oraz regularnie przyjmujący leki istotnie częściej korzystali z opieki kardiologicznej.

**Wnioski.** Istnieją pewne czynniki wpływające na niedostateczną współpracę w zakresie ciągłości opieki kardiologicznej u pacjentów po implantacji urządzeń wspomagających pracę serca. Indywidualne podejście do pacjentów niespełniających zaleceń lekarskich może być pomocne w zmianie indywidualnych zachowań, co wpłynie na prawidłowy przebieg leczenia.

Słowa kluczowe: elektroterapia serca, elektrofizjologia, urządzenie stymulujące pracę serca, regularność wizyt, przestrzeganie zaleceń lekarskich

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