Wearable cardioverter-defibrillators in daily clinical practice: A single-centre experience

Adam Wojtaszczyk, Krzysztof Kaczmarek, Irmina Urbanek, Iwona Cygankiewicz, Jerzy Krzysztof Wranicz

Department of Electrocardiology, Medical University of Lodz, Łódź, Poland

Correspondence to:
Adam Wojtaszczyk, MD, PhD, Department of Electrocardiology, Medical University of Lodz, Pomorska 251, 91–213 Łódź, Poland, phone: +42 201 43 60, e-mail: adam.wojtaszczyk@office365.umed.pl

DOI: 10.33963/v.phj.99309

Received:
December 27, 2023

Accepted:
February 6, 2024

Early publication date:
February 16, 2024

INTRODUCTION

A wearable cardioverter-defibrillator (WCD) is an external medical device designed to protect patients against sudden cardiac death (SCD) due to ventricular arrhythmias. The main advantage of WCDs is their non-invasive character which allows avoiding several complications associated with conventional implantable cardioverter-defibrillators (ICD). Therefore, WCD is a solution for specific groups of patients, not eligible for permanent ICD implantation.

Patients early (<40 days) after myocardial infarction with left ventricular systolic dysfunction (left ventricular ejection fraction [LVEF] <35%) have an increased risk of SCD. This group was postulated to benefit from WCD most. However, the VEST study provided inconclusive evidence [1]. While total mortality was lower in the WCD group, the incidence of sudden or arrhythmic death was comparable. It is worth noting that the majority of the patients who died in the WCD group did not wear the device at the moment of death. Thus, recent guidelines by the European Society of Cardiology recommend that WCD therapy may be considered in this group [2]. Patients with LVEF <35% and after coronary artery bypass grafting or non-complete percutaneous revascularisation may also benefit from WCD [3]. WCD should be also considered in all patients with indications for secondary prevention of SCD in whom ICD cannot be temporarily implanted, such as those undergoing antibiotic therapy following transvenous lead extraction due to infective endocarditis [2, 3]. WCD may be considered in patients awaiting heart transplantation [2]. There are also several clinical situations in which an increased risk of SCD is potentially reversible: acute myocarditis, peripartum cardiomyopathy, takotsubo cardiomyopathy, and cardiac failure during oncological treatment. Although there is little evidence, those patients may be candidates for WCD [3]. Previous observations indicate that patients with newly diagnosed non-ischemic cardiomyopathy (NICM) with severe left ventricular dysfunction are at higher risk of SCD. WCD could protect them till the optimal HF pharmacotherapy is established and LVEF has improved [4].

Several studies have investigated WCD therapy in real-life populations. WEARIT-II and WEARIT-France are two big registries that show that WCD therapy is effective and safe in selected patients with a transient increased risk of SCD [5, 6]. Apart from SCD protection, WCD provides also permanent telemetric monitoring which in several situations may allow for greater insight into patients' disease [7, 8]. We aim to present a Polish single-center experience with WCD.

METHODS

Clinical data of 19 consecutive patients protected by WCD (LifeVest, Zoll-LifeCor, Pittsburgh, PA, US) from November 2021 to December 2023 were analyzed. All patients were diagnosed and treated in the Department of Electrocardiology, Medical University of Lodz, Poland. Data on clinical characteristics, details of WCD use as well as events during follow-up were analyzed based on clinical charts. Patients were treated with WCD according to current guidelines. Indications for conventional ICD implantation or patients' severe condition that made them unable to leave the hospital were the main contraindications for WCD use. In all cases, WCD was programmed according to manufacturer recommendations — 150 be-

Table 1. Characteristics and outcomes for patients treated with wearable cardioverter-defibrillator

Patient	Age, years	Sex M – male F – female	Etiology	SCD Prevention P – primary S – secondary	LVEF at the beginning of WCD therapy, %	Duration of WCD therapy, days	Compliance with WCD therapy during the day, hours, and minutes	LVEF at the end of WCD therapy, %	Arrhythmias recorded by WCD	Need for ICD implantation after WCD therapy
1	61	F	DCM *de novo*	P	27	1	5 h 20 min	27	None	Lack of consent to ICD
2	37	M	DCM *de novo*	P	20	87	23 h 53 min	50	None	No further indications for ICD
3	69	M	Wide QRS tachycardia, myocarditis	S	52	53	23 h 18 min	52	AVRT	No further indications for ICD
4	52	M	DCM *de novo*	P	17	63	13 h 56 min	28	None	S-ICD
5	53	M	Early phase post MI with reduced LVEF	P	13	92	16 h 15 min	10	None	ICD
6	50	M	Early phase post MI with reduced LVEF, myocarditis	P	16	94	23 h 49 min	25	VT	CRT-D
7	48	M	VT post RFA	S	62	40	23 h 49 min	62	None	No further indications for ICD
8	57	M	VT early post MI	S	30	94	23 h 44 min	40	None	No further indications for ICD
9	29	M	DCM *de novo*	P	26	79	16 h 19 min	59	None	No further indications for ICD
10	62	M	ICM, ICD HV lead electrical dysfunction	S	15	32	23 h 54 min	15	None	Replace of dysfunctional HV lead
11	72	M	ICM, ICD HV lead electrical dysfunction	S	15	61	23 h 56 min	15	None	Replace of dysfunctional HV lead
12	34	M	DCM *de novo*	P	10	81	20 h 25 min	12	None	S-ICD
13	37	M	Myocarditis	S	64	56	19 h 26 min	69	None	No further indications for ICD
14	67	M	DCM *de novo*	P	16	59	23 h 53 min	25	None	CRT-D
15	78	M	ICM, ICD HV lead electrical dysfunction	P	25	89	23 h 35 min	25	None	Replace of dysfunctional HV lead
16	50	M	ICM, ICD HV lead electrical dysfunction	S	18	78	23 h 53 min	18	None	Replace of dysfunctional HV lead
17	33	M	DCM *de novo*	P	11	96	23 h 55 min	25	None	S-ICD
18	29	M	DCM *de novo*	P	26	34	13 h 11 min	21	None	ICD
19	66	M	ICM, ICD HV lead electrical disfunction	S	27	52	24 h	22	None	Replace of dysfunctional HV lead

Abbreviations: CRT-D, cardiac resynchronisation therapy defibrillator; DCM, diluted cardiomyopathy; HV, high voltage; ICD, implantable cardioverter-defibrillator; ICM, ischemic cardiomyopathy; LVEF, left ventricular ejection fraction; MI, myocardial infarction; RFA, radio frequency ablation; S-ICD, subcutaneous cardioverter-defibrillator; SCD, sudden cardiac death; VT, ventricular tachycardia

ats per minute for ventricular tachycardia (VT) zone and 200 beats per minute for ventricular fibrillation zone.

Statistical analysis

Continuous variables with normal distribution were presented as means and standard deviations (SD) while other than normal distribution as medians with interquartile ranges (IQR). Qualitative variables were presented as numbers (percentages).

RESULTS AND DISCUSSION

The registry included 19 patients at a mean (SD) age of 51.8 (15.3) years. Most of them were men (95.7%). Clinical characteristics and outcomes are presented in Table 1. Newly diagnosed dilated cardiomyopathy (DCM) was considered the main indication for WCD use (n = 8, 42.1%). Four of five patients with ICD defibrillation lead dysfunction were initially implanted in secondary prevention of SCD. All indications are summarized in Supplementary material, *Figure S1*.

The median (IQR) LVEF at the beginning of WCD therapy was 20% (15.3–27). The mean (SD) WCD treatment duration was 65 days (26), and the mean (SD) wearing time was 20 hours and 36 minutes (5 h 12 min). Only one patient interrupted WCD therapy after one day due to skin condition.

After WCD treatment, more than one-third of the patients lost the indications for permanent ICD therapy (n = 7, 36.8%) due to improvement in LVEF. The remaining patients were implanted with ICD, cardiac resynchronisation therapy, and subcutaneous ICD devices as shown in Supplementary material, *Figure S2*. After excluding the patients with previously implanted ICD/cardiac resynchronisation therapy defibrillator in whom defibrillation-lead dysfunction occurred, half of the group avoided permanent ICD therapy (n = 7, 50%).

None of our patients received shock from the WCD. In one case, sustained VT was recorded, but the patient suspended therapy. One patient was admitted to the department for an urgent ablation due to recurrent supraventricular tachycardia mimicking ventricular tachycardia recorded by telemetric monitoring.

The baseline clinical characteristic of the analyzed population was comparable to other reported WCD populations [1, 5, 9–11]. However, our patients were much younger compared to those from previously mentioned trials. While the mean age in our group was 51.8 years, most registries reported a mean age of above 60 years [1, 5, 9–11]. A potential explanation of this observation could be the fact that in the analyzed population there was a low percentage of patients after myocardial infarction and a relatively large number of patients with ICD malfunction.

Most of the patients were treated with WCD in primary prevention of SCD. Similar proportions were reported in the Austrian WCD Registry [12]. The main indication for WCD therapy was new-onset NICM. In other observational studies, NICM patients were also a substantial part of treated populations [9–11, 13].

Median baseline LVEF was similar to other studies [5, 11]. Only in one Austrian registry, LVEF at the beginning of WCD therapy was noticeably higher (33%) [12]. In our population, more than one-third of the patients did not require further ICD implantation, mainly due to improvement in LVEF. This proportion increased up to 50% when patients with previously implanted ICDs were not included. In a recently reported registry from Germany, avoidance of permanent ICD therapy was possible in 58% of cases [10]. Sinha et al. [9] reported that after 90 days of WCD use, improvement in LVEF >35% was observed in 37% of patients. Röger et al. [11] observed significant improvement in LVEF in both ICM and NICM patients at the end of WCD use. This resulted in permanent ICD implantation only in 51.4% of patients treated with WCD. The higher rate of ICD implantation in our population (36.8%) was mainly due to the more frequent use of WCD in patients with ICD dysfunction (26.2%).

Wearable cardioverter-defibrillator therapy duration varies among the studies. In the WEARIT-II registry, the median duration was the longest (90 days) [5]. In other registries, the median WCD therapy duration was shorter. In the Austrian population, it was 68.8 days [5, 12]. Rosenkaimer et al. [9] reported a median of 65.1 days while Sinha et al. [10] a median of 48 days in two different German populations. Compared to them, the mean duration of WCD treatment in our population did not differ significantly.

Previous studies imply that sufficient wearing time indicating better proper compliance is crucial for gaining a benefit from WCD [1]. The mean time of WCD usage in our population was much longer compared to the VEST trial (20.6 h, SD 5.2 vs. 14 h, SD 9.3). However, observational studies reported much longer wearing time (>20 h) [5, 9–11].

In the analyzed population, WCD therapy was safe, well-tolerated, and adherent. Time gained due to WCD use allowed avoiding device implantation in more than one-third of patients, and, after excluding patients with previously implanted ICDs in 50% of cases.

Supplementary material

Supplementary material is available at https://journals.viamedica.pl/polish_heart_journal.

Article information

Conflict of interest: JKW is a medical consultant for Zoll Medical Corporation. Other authors declare no conflict of interest.

Funding: None.

REFERENCES

1. Lee BK, Pletcher MJ, Olgin JE, et al. VEST Investigators. Wearable cardioverter-defibrillator after myocardial infarction. N Engl J Med. 2018; 379(13): 1205–1215, doi: 10.1056/NEJMoa1800781, indexed in Pubmed: 30280654.
2. Könemann H, Dagres N, Merino JL, et al. ESC Scientific Document Group. 2022 ESC Guidelines for the management of patients with ventricular arrhythmias and the prevention of sudden cardiac death. Eur Heart J. 2022; 43(40): 3997–4126, doi: 10.1093/eurheartj/ehac262, indexed in Pubmed: 36017572.
3. Sterliński M, Oręziak A, Przybylski A, et al. Experts of the Heart Rhythm Section of the Polish Cardiac Society: opinion on the use of wearable cardioverter-defibrillators in Poland. Kardiol Pol. 2019; 77(2): 238–243, doi: 10.5603/KP.2019.0031, indexed in Pubmed: 30816992.
4. Duncker D, Veltmann C. Role of the wearable defibrillator in newly diagnosed heart failure. Curr Heart Fail Rep. 2018; 15(6): 368–375, doi: 10.1007/s11897-018-0415-7, indexed in Pubmed: 30353399.
5. Kutyifa V, Moss AJ, Klein H, et al. Use of the wearable cardioverter defibrillator in high-risk cardiac patients: data from the Prospective Registry of Patients Using the Wearable Cardioverter Defibrillator (WEARIT-II Registry). Circulation. 2015; 132(17): 1613–1619, doi: 10.1161/CIRCULATIONAHA.115.015677, indexed in Pubmed: 26316618.
6. Garcia R, Combes N, Defaye P, et al. Wearable cardioverter-defibrillator in patients with a transient risk of sudden cardiac death: the WEARIT-Fran-

ce cohort study. Europace. 2021; 23(1): 73–81, doi: 10.1093/europace/euaa268, indexed in Pubmed: 33257972.
7. Chyży T, Małecka B, Bednarek J, et al. A wearable cardioverter-defibrillator vest as a diagnostic and therapeutic tool after COVID-19. Kardiol Pol. 2023; 81(7-8): 800–801, doi: 10.33963/KP.a2023.0128, indexed in Pubmed: 37270834.
8. Pilawa M, Kaźmierczak J, Kiedrowicz RM. An optimized long QT syndrome differentiating protocol: A new indication for wearable cardioverter-defibrillator vests. Kardiol Pol. 2022; 80(7-8): 857–858, doi: 10.33963/KP.a2022.0142, indexed in Pubmed: 35677993.
9. Sinha AM, Bense J, Hohenforst-Schmidt W. The impact of wearable cardioverter-defibrillator use on long-term decision for implantation of a cardioverter-defibrillator in a semirural acute care hospital. J Interv Card Electrophysiol. 2021; 62(2): 401–407, doi: 10.1007/s10840-020-00898-5, indexed in Pubmed: 33200285.
10. Rosenkaimer SL, El-Battrawy I, Dreher TC, et al. The wearable cardioverter-defibrillator: Experience in 153 patients and a long-term follow-up. J Clin Med. 2020; 9(3), doi: 10.3390/jcm9030893, indexed in Pubmed: 32214048.
11. Röger S, Rosenkaimer SL, Hohneck A, et al. Therapy optimization in patients with heart failure: the role of the wearable cardioverter-defibrillator in a real-world setting. BMC Cardiovasc Disord. 2018; 18(1): 52, doi: 10.1186/s12872-018-0790-8, indexed in Pubmed: 29544442.
12. Odeneg T, Ebner C, Mörtl D, et al. Indications for and outcome in patients with the wearable cardioverter-defibrillator in a nurse-based training programme: results of the Austrian WCD Registry. Eur J Cardiovasc Nurs. 2019; 18(1): 75–83, doi: 10.1177/1474515118790365, indexed in Pubmed: 30064269.
13. Weiss M, Michels G, Eberhardt F, et al. Anxiety, depression and quality of life in acute high risk cardiac disease patients eligible for wearable cardioverter defibrillator: Results from the prospective multicenter CRED-registry. PLoS One. 2019; 14(3): e0213261, doi: 10.1371/journal.pone.0213261, indexed in Pubmed: 30856204.