Wearable cardioverter-defibrillator in daily clinical practice: a single-centre experience

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Wearable cardioverter-defibrillator in daily clinical practice: a single-centre experience

Short title: A single-centre experience with wearable cardioverter-defibrillator

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INTRODUCTION
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 WCD is its non-invasive character which allows to avoid several complications associated with conventional implantable cardioverter-defibrillator (ICD). Therefore, WCD is a solution for specific groups of patients, not eligible for permanent ICD implantation.

Patients early (<40 days) after myocardial infarction and left ventricle systolic disfunction (left ventricular ejection fraction [LVEF] <35%) have increased risk of SCD. This group was postulated to benefit from WCD most. However, VEST study provided inconclusive evidences [1]. While total mortality was lower in WCD group, incidence of sudden or arrhythmic death was comparable. It is worth noting that majority of the patients who died in WCD group did not wear it at the moment of death. Thus, recent guidelines by European Society of Cardiology recommend that WCD therapy may be considered in this group [2]. Also patients with LVEF <35% and after coronary artery bypass grafting or non-complete percutaneous revascularisation may benefit from WCD [3]. WCD should be as well considered in all patients with indications for secondary prevention of SCD in whom ICD cannot be temporarily implanted like those undergoing antibiotics therapy following transvenous lead extraction due to infective
endocarditis [2, 3]. WCD may be considered in patients awaiting for heart transplantation [2]. There are also several clinical situations in which 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-ischaemic cardiomyopathy (NICM) with severe left ventricle disfunction are at higher risk of SCD. WCD could protect them till the optimal HF pharmacotherapy will be established and LVEF will improve [4]. Several studies have investigated WCD therapy in real-life populations. WEARIT-II and WEARIT-France are two big registries which prove that WCD therapy is effective and safe in selected patients with 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 in patients’ disease [7, 8]. We aim to present a Polish single-centre experience with WCD.

**METHODS**

Clinical data of 19 consecutive patients protected with WCD (LifeVest, Zoll-LifeCor, Pittsburgh, PA, US) since November 2021 till December 2023 have been analysed. All patients were diagnosed and treated in Department of Electrocardiology, Medical University of Lodz, Poland. Data on clinical characteristics, details of WCD use as well as events during follow up was analysed based on clinical charts. Patients were treated with WCD according to current guidelines. Indications for conventional ICD implantation or patients severe condition make them unable to leave the hospital were main contraindications for WCD use. In all cases, WCD was programmed according to manufacturer recommendations — 150 beats per minute for ventricular tachycardia (VT) zone and 200 beats per minute for ventricular fibrillation zone.

**Statistical analysis**

Continuous variables with normal distribution are presented as mean and standard deviation (SD) while other than normal distribution as median with interquartile range (IQR). Qualitative variables are presented as numbers (percentage).

**RESULTS AND DISCUSSION**

The registry includes 19 patients with 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 as the main indication for WCD use (n = 8, 42.1%). Four out of five patients with ICD defibrillation lead disfunction 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). Mean (SD) WCD treatment duration was 65 days (26) and mean (SD) wearing time was 20 hours and 36 minutes (5 h 12 min). Only one patient interrupted the 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, CRT and S-ICD devices as shown in Supplementary material, Figure S2. After excluding patients with previously implanted ICD/CRT-D in whom defibrillation lead disfunction occurred, half of the group avoid permanent ICD therapy (n = 7, 50%).

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

Baseline clinical characteristic of analysed 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 mean age in our group was 51.8 years, most registries reported mean age of above 60 years [1, 5, 9–11]. Potential explanation of this observation could be fact that in analysed population there was low percentage of patients after myocardial infarction and 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 Austrian WCD Registry [12]. Main indication for WCD therapy was new-onset NICM. In other observational studies, NICM patients were also 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 the 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 of LVEF. This proportion has increased up to 50% when patients with previously implanted ICD were not included. In 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 of LVEF >35% was observed in 37% patients. Röger et al.
observed significant improvement of LVEF in both ICM and NICM at the end of WCD use. This has resulted in permanent ICD implantation only in 51.4% patients treated with WCD. Lower rate of ICD implantation avoidance in our population (36.8%) was mainly due to more frequent use of WCD in patients with ICD disfunction (26.2%).

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

Previous studies imply that is sufficient wearing time indicating better proper compliance is crucial for gaining a benefit from WCD [1]. Mean time of WCD usage in our population was much longer compared to 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 analysed population, WCD therapy was safe, well-tolerated and adherent. Time gained due to WCD use allowed to avoid device implantation in more than one third of patients, and after exclusion patients with previously implanted ICD in 50% of cases.

**Supplementary material**

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

**Article information**

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

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**REFERENCES**


Table 1. Characteristic and outcomes of patients treated with wearable cardioverter-defibrillator

<table>
<thead>
<tr>
<th>Patient</th>
<th>Age, years</th>
<th>Sex</th>
<th>Etiology</th>
<th>SCD Prevention</th>
<th>LVEF at the beginning of WCD therapy, %</th>
<th>Duration of WCD therapy, days</th>
<th>Compliance of WCD therapy during the day, hours and minutes</th>
<th>LVEF at the end of WCD therapy, %</th>
<th>Arrhythmias recorded by WCD</th>
<th>Need for ICD implantation after WCD therapy</th>
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<tbody>
<tr>
<td>1</td>
<td>61</td>
<td>F</td>
<td>DCM de novo</td>
<td>P</td>
<td>27</td>
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<td>5 h 20 min</td>
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<td>M</td>
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<td>3</td>
<td>69</td>
<td>M</td>
<td>Wide QRS tachycardia, myocarditis</td>
<td>S</td>
<td>52</td>
<td>53</td>
<td>23 h 18 min</td>
<td>52</td>
<td>AVRT</td>
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<td>M</td>
<td>DCM de novo</td>
<td>P</td>
<td>17</td>
<td>63</td>
<td>13 h 56 min</td>
<td>28</td>
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<tr>
<td>5</td>
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<td>M</td>
<td>Early phase post MI with reduced LVEF</td>
<td>P</td>
<td>13</td>
<td>92</td>
<td>16 h 15 min</td>
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<td>Early phase post MI with reduced LVEF, myocarditis</td>
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<td>16</td>
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<tr>
<td>7</td>
<td>48</td>
<td>M</td>
<td>VT post RFA</td>
<td>S</td>
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<td>40</td>
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<td>59</td>
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<td>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</td>
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