

Optimal hospital discharge time after cardiac implantable electronic device implantation: A retrospective study from a tertiary electrotherapy center

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DOI: 10.33963/v.kp.97210

Received:

May 11, 2023

Accepted:

August 28, 2023

Early publication date:

September 15, 2023

INTRODUCTION

Despite many publications on early complications of cardiac implantable electronic device (CIED) implantations, there are no specific recommendations on the suggested discharge time after such procedures. This retrospective pilot observation aimed to evaluate the occurrence of early complications following CIED implantations, which could inform optimal post-procedural patient management and timing of discharge.

METHODS

This retrospective study included patients who underwent a cardiac implantable electronic device (CIED) implantation procedure, with at least one lead implanted, between January 1, 2021 and December 31, 2021. Implantation procedures were also included if they were immediately followed by a reimplantation. Patients who underwent only explantation and those who had pulse generator replacement were excluded from the study. All CIED implantations were performed in the Department of Cardiology and Electrotherapy, Medical University of Gdańsk. The standard policy in our center was to discharge patients two days after the lead implantation, with a routine chest X-ray on the first day after the procedure. After discharge from the hospital, patients were then routinely invited for the first check-up approximately 3 months after CIED implantation. In exceptional situations (patients after lead reposition due to dislodgment, pocket hematoma not eligible for intervention, suboptimal lead parameters), patients were asked to report to the clinic on

the 7th day after the procedure to remove the sutures and to check CIED parameters. The demographic data, the type of procedure, comorbidities, laboratory test results, and pharmacological treatment were obtained from patients' electronic medical records available in the hospital's database and then precisely analyzed. Data on frequently occurring comorbidities (chronic heart failure [CHF], atrial fibrillation, hypertension, coronary artery disease [CAD], type 2 diabetes mellitus, stroke or transient ischemic attack, chronic kidney disease, and active cancer) were extracted from the discharge summary at the time of the implantation procedure. Detection of a complication related to CIED implantation within the first 30 days after the procedure was qualified as the endpoint.

Statistical analysis

For all comparisons and calculations, a *P*-value of less than 0.05 was assumed as statistically significant. Numerical variables were expressed as means (SD) if normally distributed or as medians (interquartile range [IQR]). In the case of continuous variables, normal distribution was tested using the one-sample Kolmogorov–Smirnov test. Categorical data were expressed as numbers and percentages. Numerical variables were compared using the independent-sample parametric (unpaired Student *t*) or nonparametric (Mann–Whitney *U*) tests. Categorical variables were compared using the χ^2 test or Fisher's exact test when appropriate. Correlations between selected quantitative variables were assessed using the Spearman rank correlation test. The

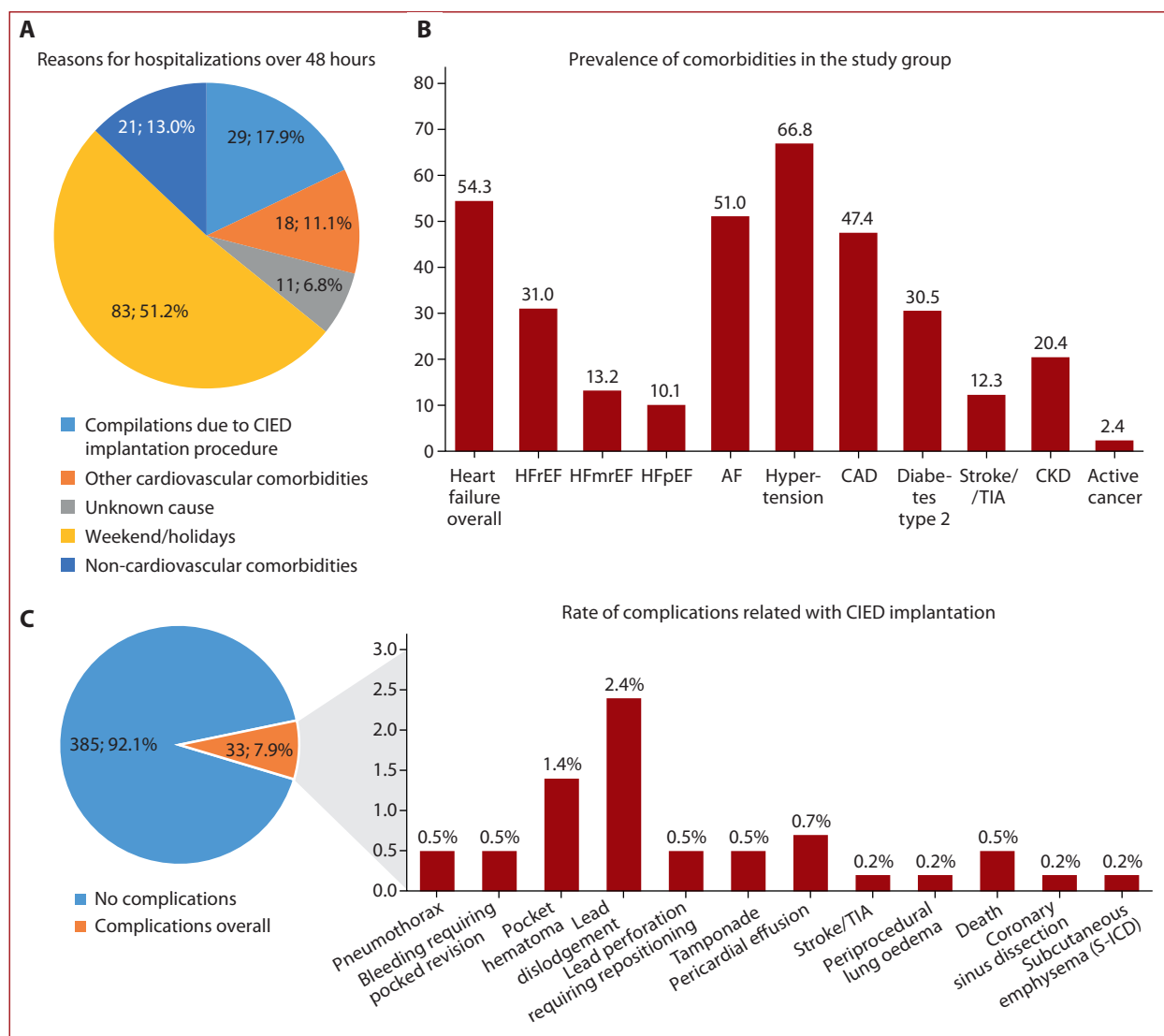


Figure 1. A. Reasons for hospitalizations beyond 48 hours. B. Prevalence of comorbidities in the study group. C. Rate of complications related to CIED implantation

Abbreviations: AF, atrial fibrillation; CIED, cardiac implantable electronic devices; CAD, coronary artery disease; CKD, chronic kidney disease; HFmrEF, heart failure with mid-range ejection fraction; HFpEF, heart failure with preserved ejection fraction; HFrEF, heart failure with reduced ejection fraction; S-ICD, subcutaneous implantable cardioverter-defibrillator; TIA, transient ischemic attack

ultimate analysis to determine risk factors of complications after CIED procedures was based on logistic regression. The multivariable analysis included variables that had yielded statistical significance defined as a P -value of 0.1 or lower, in the univariate analysis. The data were analyzed using Statistica 13 software. The study was approved by the bioethics committee (no. NKBBN/644/2022).

RESULTS AND DISCUSSION

Four hundred sixteen CIED procedures were included in the study, of which 325 (78.1%) were *de novo* CIED implantation procedures. The majority of the study group were men ($n = 261$, 62.7%) at a mean (SD) age of 70 (14) years. The most common comorbidities in the study group were hypertension, CHF, and CAD (Figure 1B). The median (IQR) hospitalization time was 5 (3–8) days. The median (IQR) time from procedure to hospital discharge was 2 (2–3)

days. In 162 cases (38.9%), the time to discharge after the procedure was >2 days. It should be emphasized that 51.2% of these prolonged stays occurred due to weekends/holidays following the lead implantation procedure, and in another 11.1% of cases no clear medical reason explaining prolonged hospitalization could be identified (Figure 1A). The time to discharge was found to increase with higher levels of B-type natriuretic peptide ($P = 0.01$; $r = 0.14$) and lower left ventricular ejection fraction ($P = 0.02$; $r = -0.12$). The descriptive characteristics of the study group are presented in the Supplementary material, Table S1.

Complications related to CIED implantation were found in 33 patients (7.9%), with lead dislodgment being the most prevalent ($n = 10$). Most complications (84.8%) were detected within the first 24 hours after the procedure, and 91.0% were found within the first 48 hours. Complications that occurred beyond 24 hours were pocket hematoma

($n = 3$), perforation requiring lead reimplantation — found on the 24th day after the procedure ($n = 1$), and ischemic stroke observed on the second day after the procedure ($n = 1$). There was one case of death on the 3rd day after the procedure due to aspiration at the time of the procedure and the resulting complicated aspiration pneumonia (Figure 1C).

Patients who experienced CIED-related complications were more likely to have been previously diagnosed with CHF ($P = 0.03$) and CAD ($P = 0.02$). Patients with complications observed later than 24 hours after procedures were characterized by a significantly higher median (IQR) age-adjusted Charlson comorbidity index (7 [6–8] vs. 5 [3–6] points, $P = 0.03$) and were significantly more often treated with vitamin K antagonists (VKA) (2 [15.4%] vs. 3 [11.5%]; $P = 0.04$). A univariate analysis proved that CAD (odds ratio [OR], 2.38; 95% CI, 1.12–5.04; $P = 0.02$) and CHF (OR, 2.41; 95% CI, 1.09–5.33; $P = 0.03$) were associated with a higher risk of complications, whereas regarding C-reactive protein concentration, a tendency toward a higher risk of complications was observed (OR, 0.96; 95% CI, 0.016–0.99; $P = 0.09$). Multivariable analysis identified CAD as the only independent predictor of the subsequent complications (OR, 2.26; 95% CI, 1.06–4.79; $P = 0.03$).

Based on the literature data, it is known that most very early complications following CIED procedures occur within the first 6 hours after the procedure, which makes discharge from the hospital on the day of the procedure safe and preferred by patients [1–3]. Some authors go a step further, proposing discharge after transvenous lead extraction performed for non-infectious reasons on the same day [4]. In contrast, Ohlow et al. state that 100% of potentially life-threatening acute complications occur during the first 72 hours [5]. These data are consistent with those obtained in our study, where, excluding a case of perforation requiring lead replacement detected only 24 days after the procedure, 100% of the complications were found within the first 72 hours after the procedure. Other authors also emphasize that lead dislodgements occur during the first few days of implantation but are not limited to the first 24 hours [6]. However, the E-MOTION trial confirmed that early mobilization at 3 hours following CIED procedures is safe and feasible compared with standard immobilization and is not associated with increased risk of periprocedural complications or the 24-month lead dislodgment rate [7]. Significant differences in the duration of hospitalization of patients after CIED implantation are observed not only between individual centers but also between countries — the median length of stay after pacemaker implantation in Japan and in the US was 8 (7–11) and 1 (1–3) days, respectively [8]. Finally, it seems that the decision on early discharge following CIED procedures should still be individualized, and extended stay should apply to patients with pacemaker dependency, especially after lead implantation/extraction or pocket revision, patients with increased

risk of bleeding or thrombosis/thromboembolism, patients with hemodynamic instability, patients with comorbidities requiring continued observation and other risk factors for complications [6]. Based on the data in our study, patients with multiple comorbidities, patients treated with VKA, and those with CAD require longer observation.

The financial aspect is also significant. The strategy of early discharge on the first day after the procedure with no exceptions for weekends or holidays could potentially save 150 euros per patient/day. Moreover, such an approach would allow shorter waiting times for patients awaiting elective CIED implantation.

In connection with the obtained results, an echocardiogram aimed at assessing the pericardium is performed in patients after CIED implantation to detect fluid in the pericardium before discharge from the hospital.

CONCLUSIONS

The complication rate after CIED procedures is low but not negligible, with complications occurring mainly on the first day after the procedure. Considering the growing costs of hospitalization and prolonged waiting time for elective electrotherapy procedures, it seems safe and justified to discharge selected patients without risk factors for subsequent complications on the first day after CIED implantation. Early follow-up appointments at the hospital outpatient center and remote monitoring could facilitate detection of rare delayed complications, such as pocket hematomas or lead dislodgment/heart perforation.

Supplementary material

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

Article information

Conflict of interest: None declared.

Funding: None.

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