



# What could go wrong: a risk-based strategy for patient discharge after CIED procedures

Anne Hamilton Dougherty<sup>1</sup>

Received: 30 September 2022 / Accepted: 5 October 2022

© The Author(s), under exclusive licence to Springer Science+Business Media, LLC, part of Springer Nature 2022

Cardiac implantable electronic devices (CIED) contribute to the well-being and survival of countless patients, but they are not without risk. Whereas the technical safety and functionality of these products have improved over time, complications do still occur. Expanded indications for implantation today include more aged populations with more severe cardiac conditions who also carry greater comorbidities. The burden of comorbidities in any individual predicts the risk of pericardial, cardiac, and bleeding procedural complications, length of stay, and in-hospital mortality, as well as hospital cost [1]. Many procedural complications, such as pneumothorax, pericardial effusion, hematoma, and lead dislodgement, can be recognized and mitigated within the first 24 h post implant, leading many physicians to observe patients overnight prior to discharge. Shoulder immobilization and bed rest of varying durations have been routinely prescribed to prevent lead dislodgement.

Others argue for early mobilization and discharge in order to preserve mobility and comfort even in the elderly [2]. Disorientation and sundowning are more likely to occur in hospital settings, increasing the likelihood of early lead dislodgement, so some surmise that more familiar surroundings could better preserve orientation and compliance with positional instructions. Overnight observation does increase hospital costs. On the other hand, patients requiring supplemental assistance post implant at home may also incur costs for personal care not necessarily covered by insurance. The tension between safety, patient comfort, and efficiency

in postoperative management continues to weigh heavily in individual discharge decisions.

What role do bedrest and immobilization actually play in preventing lead dislodgement and other complications? Most dislodgements occur during the first few days of the implant but are not limited to the first 24 h. A meta-analysis reports an overall incidence of lead dislodgement ranging from 1 to 2.69% in individual studies, with a mean of 1.63% [3]. Atrial leads were more likely than ventricular leads to dislodge, and MRI conditional leads dislodged more frequently than standard leads. Active fixation leads demonstrated no significant advantage in dislodgement rates in this study. Leads develop stability with fibrotic changes at the myocardial interface, a process that continues for weeks or longer. The elderly experience higher dislodgement rates disorientation and limited mobility both contribute to enhanced risk. Lead malfunction can be catastrophic in pacemaker-dependent patients, therefore early detection and intervention are critical to quality care. Dislodgement in those less dependent on pacing can be managed on a less urgent schedule.

Does prolonged observation contribute to infection prevention? The strongest evidence for benefit of antimicrobial prophylaxis can be demonstrated with intravenous administration timed to achieve therapeutic blood levels at the time of skin incision. The use of antibacterial envelopes also reduces pocket infection rates [4]. No additional benefit has been conclusively demonstrated with additional doses of prophylactic antibiotics, except for anecdotal evidence in patients with particular comorbidities predisposing to infection.

Hematoma development significantly increases the risk of device infection, therefore thoughtful coagulation management serves dual purposes. Meticulous intraoperative hemostasis is the cornerstone of management, although late bleeding can occur in anticoagulated patients. Many patients require uninterrupted oral anticoagulants (OAC) throughout the perioperative period, posing a particular risk of bleeding and also thus infection. Uninterrupted OAC is preferable to IV heparin bridging to prevent hematoma formation [4].

---

This comment refers to the article available at <https://doi.org/10.1007/s10840-022-01319-5>

---

✉ Anne Hamilton Dougherty  
Anne.H.Dougherty@uth.tmc.edu

<sup>1</sup> Division of Cardiology, Department of Internal Medicine, McGovern Medical School, University of Texas Health Science Center, 6431 Fannin, MSB 1.246, Houston, TX 77030, USA

Compression bandaging of varying styles and effectiveness is widely employed to prevent hematoma development. Notably, both OAC and compression techniques can be provided as an outpatient, however disoriented or uncooperative patients benefit from direct supervision during recovery.

In this issue, Archontakis et al. provide additional insight into the safety of same-day discharge after CIED implantation and generator exchange [5]. The COVID-19 pandemic prompted an abrupt change in their hospital protocol to favor short-stay discharge after CIED procedures, and this prospective cohort was compared to an immediately preceding historical cohort of 932 patients meeting the same inclusion criteria. All patients referred for CIED during a 16-month period were screened for actionable high-risk factors for pacer dependency, bleeding, thrombosis, and hemodynamic instability, as well as other conditions requiring continued hospitalization. A total of 821 of 965 patients not excluded by those factors were committed to a short-stay same-day discharge protocol. Formal re-triage two to 3 h postop determined whether or not each patient continued to meet criteria for early discharge. Twenty-nine patients crossed over to extended stay after the procedure due to changes in risk profile. A total of 792 out of the original 932 patients were discharged on the day of operation. They experienced no significant difference in the incidence of either early or delayed complications, compared to the historical controls.

Additionally, 84% of patients surveyed preferred same-day discharge to an overnight stay, and 72% reported no anxiety with home management. The overarching anxiety and community infection risk created by the ongoing pandemic very likely colored patients' perception of the relative safety and comfort of home compared to hospital conditions. Patient satisfaction should be reexamined in the context of post-pandemic times.

These results should not be interpreted as implying that routine same-day discharge is appropriate for all patients. The study compared a risk-calculating protocol to determine those eligible for early discharge to a standardized overnight stay protocol. The key finding is that thoughtful individual risk assessment with step-wise triage can be useful in identifying patients who can safely be discharged early.

Additional considerations not emphasized in this paper should be directed to whether individual patients with mobility or cognitive issues can be assisted better in the home or hospital setting. Whereas it may be preferable to mobilize some early and return them to familiar surroundings, others may not possess the resources and home support systems needed to safely recover. Table 1 summarizes factors to assess preoperatively and reconsider thoughtfully in postoperative discharge planning.

**Table 1** Factors to weigh in determining length of stay after CIED implantation

Pacemaker—dependency, especially after lead implantation or revision
Elevated risk of bleeding or thrombosis/thromboembolism
Hemodynamic instability
Comorbidities requiring continued observation
Adverse intraoperative events or observations elevating the risk of pneumothorax, pericardial effusion, or hematoma
Mobility and cognitive status and response to procedural sedation
Home support systems

## References

1. Ajibawo T, Okunowo O, Okunade A. Impact of comorbidity burden on cardiac implantable electronic devices outcomes. *Clin Med Insights Cardiol.* 2022;27(16):11795468221108212. <https://doi.org/10.1177/11795468221108212>.
2. Budano C, Garrone P, Castagno D, Bissolino A, Andreis A, Bertolo L, Mazzini D, Bergamasco L, Marra S, Gaita F. Same-day CIED implantation and discharge: is it possible? The E-MOTION trial (Early MOBilization after pacemaker implantaTION). *Int J Cardiol.* 2019;1(288):82–6. <https://doi.org/10.1016/j.ijcard.2019.04.020>.
3. Wang Y, Hou W, Zhou C, Yin Y, Lu S, Liu G, Duan C, Cao M, Li M, Toft ES, Zhang HJ. Meta-analysis of the incidence of lead dislodgement with conventional and leadless pacemaker systems. *Pacing Clin Electrophysiol.* 2018;41(10):1365–71. <https://doi.org/10.1111/pace.13458>.
4. Blomström-Lundqvist C, Traykov V, Erba PA, Burri H, Nielsen JC, Bongiorni MG, Poole J, Boriani G, Costa R, Deharo JC, Epstein LM, Sághy L, Snygg-Martin U, Starck C, Tascini C, Strathmore N. European Heart Rhythm Association (EHRA) international consensus document on how to prevent, diagnose, and treat cardiac implantable electronic device infections—endorsed by the Heart Rhythm Society (HRS), the Asia Pacific Heart Rhythm Society (APHRS), the Latin American Heart Rhythm Society (LAHRS), International Society for Cardiovascular Infectious Diseases (ISCVID), and the European Society of Clinical Microbiology and Infectious Diseases (ESCMID) in collaboration with the European Association for cardio-thoracic surgery (EACTS). *Eur Heart J.* 2020;41(21):2012–32. <https://doi.org/10.1093/eurheartj/ehaa010>.
5. Archontakis S, Oikonomou EK, Sideris K, Laina A, Tirovola D, Paraskevopoulou D, Kostakis P, Doundoulakis I, Arsenos P, Ntalakouras I, Charitakis E, Gatzoulis K, Tsioufis K, Sideris S. Safety of same-day discharge versus overnight stay strategy following cardiac device implantations. A high-volume single centre experience. *J Interv Card Electrophysiol.* 2022;5:1–11. <https://doi.org/10.1007/s10840-022-01319-5>.

**Publisher's note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.