

How to Manage Implantable Cardiac Defibrillator Protection in an Implantable Cardiac Defibrillator-Dependent Patient Undergoing Palliative Radiotherapy?

Palyatif Radyoterapi Uygulanan ICD Bağımlı Bir Hastada ICD Koruması Nasıl Yönetilir?

A 61-year-old female patient underwent left breast segmental mastectomy for invasive ductal carcinoma in 2011. Thereafter, trastuzumab therapy was initiated as an adjuvant chemotherapy. However, trastuzumab-related cardiotoxicity developed leading to a left ventricular ejection fraction (LVEF) value of 25% in the patient. Notably, LVEF did not improve with optimal medical treatment on follow-up. Therefore, decision-making for an implantable cardiac defibrillator (ICD) therapy (for primary prevention) was implemented. Implantable cardiac defibrillator was implanted in the right pectoral region due to left mastectomy and lymph node excision. On follow-up, positron emission computed tomography revealed metastatic lesions involving the anterior upper lobe of the right lung and right infraclavicular lymph nodes. The patient was referred to our clinics due to the fact that she had an ICD generator in the vicinity of the metastatic sites (Figure 1A). This might substantially reduce the effectiveness of planned radiotherapy on this region. Moreover, radiotherapy with a cumulative dose of >5 Gy might potentially hamper the ICD generator. Notably, the calculated dose was seemingly over this threshold according to the American Association of Physicists in Medicine Task Group 203.

Based on the abovementioned challenges, temporary removal of the ICD generator, leaving the leads in place, and reimplantation of the generator in the same region following radiotherapy were considered. However, even though the patient was not dependent on cardiac pacing by the device, the patient might be potentially labeled as "ICD dependent" due to the fact that she had recently (1 month earlier) received an appropriate ICD shock for a ventricular tachycardia (VT) episode, and hence, the removal of the ICD generator would have had life-threatening consequences. On the other hand, ICD implantation through the left axillary vein would have been quite challenging and risky due to the previous surgical procedures and regional radiotherapy. Therefore, there was a potential dilemma between effective cancer management and device protection in this context.

The Impact of Radiotherapy on Implantable Cardiac Defibrillator Devices

Implantable cardiac defibrillators might potentially improve survival in subjects prone to sudden cardiac death. Largely owing to the increased life expectancy, the incidence of malignancy has been on the rise in our country and across the globe. On the other hand, an overwhelming majority of patients with advanced malignancy are generally managed with radiotherapy. However, ICD generators may be potentially damaged during this mode of therapy. This damage might emerge as sensing defects and inappropriate shock delivery.^{2,3} On the other hand, the risk of injury significantly increases with escalating radiation doses. Any potential device injury is of crucial importance particularly in device-dependent patients.⁴ Based on this fact, patients with an ICD generator who are likely to be exposed to a radiation dose of >5 Gy are generally considered high-risk, and ICD repositioning is strongly recommended in these patients particularly if they have a significant risk for malignant arrhythmogenesis.⁵ Of note,

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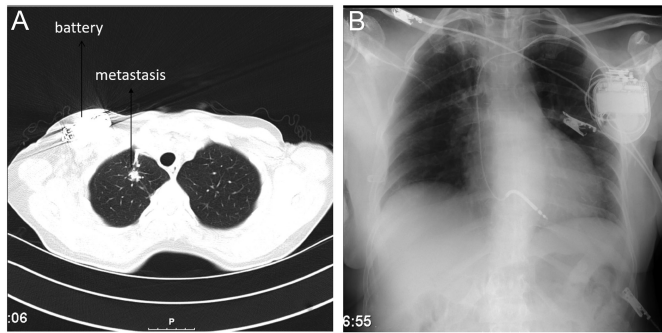


Figure 1. (A) Tomographic image of ICD battery in front of the metastatic site. (B) Telecardiographic image of the ICD battery transferred to the left pectoral region.

those with an ICD generator who are likely to be exposed to a radiation dose of <5 Gy are not considered high-risk, and hence device repositioning in these patients is generally discouraged due to the potential risk of device infection associated with the generator repositioning.⁶ In select patients, instead of repositioning the whole system, the ICD generator might be temporarily removed and reimplanted following radiotherapy; hence, the detrimental impact of radiation on the generator might be avoided. However, such an approach was not deemed appropriate for this patient due to the fact that she had a recent appropriate shock therapy and without a generator left in place would therefore be vulnerable to malignant arrhythmias in this critical period. In particular, placing a magnet on the region of the ICD generator might protect the device from harmful effects. However, this approach might temporarily inhibit defibrillation therapy, and hence, it is quite risky for a patient at high risk for fatal arrhythmias.

Possible Outcomes with Implantable Cardiac Defibrillator Repositioning Procedures and Techniques

In this context, decision-making for a wearable defibrillator seems as a viable option. This device may be preferred particularly in cases at high risk for fatal arrhythmias in whom the ICD generator needs to be temporarily removed due to therapeutic issues (as might be needed in our patient) However, a wearable defibrillator was not preferred due to the limited experience with this device in our clinic.

An alternative method might have been to leave the leads in place and simply transfer the generator to the left pectoral region and create a subcutaneous tunnel over the sternum and connect the leads to the generator in the left pectoral region via this tunnel. This method might be relatively safer as it does not require lead extraction and reimplantation. However, this method was not preferred due to its significant procedural risks (particularly during subcutaneous tunneling) in our patient who had severe cachexia.

Therefore, a transvenous shock electrode was placed in the right ventricular through an axillary vein puncture from the left pectoral region in our patient. A single lead ICD was particularly preferred due to the potential risk of venous stasis in the case of

dual lead implantation. The ICD generator in the right pectoral region was then moved to the left axillary pocket (Figure 1B). The previously implanted leads in the right pectoral region were removed with the passive traction method. The overall procedure might pose a slightly higher risk of device infection compared with the de-novo device implantation. However, high-quality sterilization was provided before and during this complex procedure in an effort to obviate further challenges (device and lead extraction due to potential infections, sepsis, etc.) The patient was discharged 1 day after the procedure without any complications. Importantly, 4 days after the procedure, the patient presented to the emergency department with an appropriate ICD shock due to a VT episode. This demonstrates that the temporary removal of the ICD generator might have been extremely risky for the patient. Of note, there was no sign of venous stasis in the left upper extremity. However, she will be under regular follow-up, particularly for potential signs of new-onset venous stasis. Finally, the patient was safely transferred to the radiation oncology clinics for the initiation of radiotherapy.

Conclusion

In conclusion, there exists no clear consensus in the current literature regarding the management of cardiac devices including ICDs likely to be exposed to radiation therapy. In patients in whom ICD repositioning seems necessary, the procedural challenges and potential complications should also be taken into consideration. However, we hold the opinion that the fundamental point that should be decisive in this context is the device dependency of the patient.

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References

1. Members ATF, Priori SG, Blomström-Lundqvist C, et al. ESC Guidelines for the management of patients with ventricular arrhythmias and the prevention of sudden cardiac death: the Task Force for the Management of Patients with Ventricular Arrhythmias and the Prevention of Sudden Cardiac Death of the European Society of Cardiology (ESC) Endorsed by: Association for European Paediatric and Congenital Cardiology (AEPC). *EP Europace*. 2015;17(11):1601-1687.
2. Hurkmans CW, Scheepers E, Springorum BG, Uiterwaal H. Influence of radiotherapy on the latest generation of implantable cardioverter-defibrillators. *Int J Radiat Oncol Biol Phys*. 2005;63(1):282-289. [\[CrossRef\]](#)

3. McCollough CH, Zhang J, Primak AN, Clement WJ, Buysman JR. Effects of CT irradiation on implantable cardiac rhythm management devices. *Radiology*. 2007;243(3):766-774. [\[CrossRef\]](#)
4. Hurkmans CW, Kneijens JL, Oei BS, et al. Management of radiation oncology patients with a pacemaker or ICD: a new comprehensive practical guideline in the Netherlands. *Radiat Oncol*. 2012;7(1):1-10.
5. Miften M, Mihailidis D, Kry SF, et al. Management of radiotherapy patients with implanted cardiac pacemakers and defibrillators: a report of the AAPM TG-203. *Med Phys*. 2019;46(12):e757-e788. [\[CrossRef\]](#)
6. Indik JH, Gimbel JR, Abe H, et al. 2017 HRS expert consensus statement on magnetic resonance imaging and radiation exposure in patients with cardiovascular implantable electronic devices. *Heart Rhythm*. 2017;14(7):e97-e153. [\[CrossRef\]](#)