Gestion de la Radiothérapie chez une patiente porteuse de stimulateur cardiaque

Management of Radiotherapy in a Patient with pacemaker

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Résumé

Les patients porteurs de stimulateurs cardiaques traités par radiothérapie sont exposés au risque de dysfonctionnement du dispositif. Vu que l'irradiation peut endommager les composants électroniques, des sociétés savantes ont émis des recommandations pour gérer ces patients. Nous rapportons le cas d'une femme de 45 ans porteuse d'un stimulateur cardiaque double chambre pour un bloc atrio-ventriculaire complet. Elle a été traitée pour un cancer du sein avec une indication à la radiothérapie adjuvante. Le pacemaker était situé hors du champ d'irradiation, seul un suivi rapproché était effectué.

Mots-clés

Stimulateur cardiaque; radiothérapie; cancer du sein; radiations électromagnétiques; interférences électromagnétique

Summary

An increasing number of patients with cardiac implantable electronic devices are treated with radiation therapy for cancer and are therefore at risk of device failure. As external beam radiation therapy can adversely impact electronic components, several learned societies published recommendations to manage such patients. We report the case of a 45-year-old woman with a dual-chamber pacemaker for complete atrioventricular block. She had breast cancer with an indication for adjuvant radiotherapy. The pacemaker was outside the irradiated field, so only a close follow-up was performed.

Keywords

Pacemaker ; radiotherapy ; breast cancer; electromagnetic radiations ; electromagnetic interference

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INTRODUCTION

The first Pacemaker (PM) implantation was on October 08th, 1958, in a Swedish Hospital, by Senningand Elmqvist; the indication was recurrent episodes of Adam Stokes (1).

The prevalence of patients treated for cancer and implanted a pacemaker is rising and counts about 1400 (2–4). External beam radiotherapy (EBR) can affect the electronic components of the cardiac implantable electronic device (CIED) and potentially cause permanent damage related either to the ionizing effect of the rays or to the interaction of electromagnetic radiations (4). So that health professionals involved in the care of this complex group of patients need to be aware of potential problems and relevant guidelines for best clinical practices (3).

CASE REPORT

We report the case of a 45-year-old patient implanted with a dual-chamber pacemaker for complete atrioventricular block following aortic valve replacement for infective endocarditis in 2012. In May 2019, the patient had left breast cancer with an indication for adjuvant radiotherapy. Before treatment, we have checked that the device was working correctly and the patient was dependent on her PM.

The PM was far from the irradiation field, on a right pre-pectoral pocket (figure1).

Figure 1 : CHEST x RAY : a PM seat on a right pre-pectoral pocket

There was no indication to move it. We organized a close follow-up protocol. We performed an electrocardiogram before and after each therapy session and a complete weekly PM interrogation. Radiotherapy sessions have passed without any incident. The patient is currently in remission of her breast cancer.

DISCUSSION

CIEDs, having a therapeutic action, have improved quality of life, exercise capacity, and survival in patients with conduction disturbances and malignant arrhythmia (5). Ionizing radiation may interfere with electric components of pacemakers or implantable cardioverter defibrillators(5). The type, severity, and extent of radiation damage to pacemakers depend on the total dose and the dose rate(2). Electromagnetic interference can generate a signal similar to a heart rhythm, detected as normal or pathological, leading to the inhibition of functioning or pacing (2).

Also, the system reset may occur. The PM reprogramming resolves this issue. However, irreversible and permanent damage still possible (3).

The risk of PM malfunction increases with the increasing dose of RT. There is no specific ‘safe’ dose to a device. Device dysfunction was reported even for doses as little as 0.15 Gy(3). However, the majority of significant malfunctions occurred above a dose of 20 Gy(3). This difference is probably due to the limited number of patients included in the studies .(3)

The guidelines of the American Association of Physicists in Medicine (AAPM) published in 1994, proposed a threshold of 2 Gy of total dose received by an implantable cardiac device beyond which there would be a high risk of malfunction(6). They established this cut-off according to data from the eighties. But, considering the technological evolution of implantable cardiac devices, some experts currently suggest a threshold of 5 Gy(6). The guidelines consider the direct amount of radiation, the dependency on the device, and the exposure to neutron-producing radiation (4).

Between 1994 and 2016, several learned societies have published their recommendations on this topic.

In 2017, the Heart Rhythm Society (HRS) published guidelines on the safe delivery of radiation therapy (RT) to patients with CIEDs. It was the first major professional

society update since 1994 (7). It is worth noting that no universal guidelines for safe radiotherapy in patients with CIED were published (8).

We managed our patient, according to the recommendations of the French Society of Radiation Oncology Therapy (SFRO) published in 2016. The main elements of these recommendations are:(6)

- Move the implantable cardiac device if it is in the field or at the edge of the treatment field;

- Before treatment: check that the device is working correctly and specify the dependency on the implantable cardiac device;

- Limit the maximum dose to 5 Gy when planning;

- During treatment, recommendations are summarized in table 1.

- After treatment, the patient should be closely followed-up.

Further device interrogation should occur at 1, 3, and 6 months after the end of RT because a malfunction of the device related to the irradiation may occur several months after the end of the irradiation(8).

The latest recommendations published in 2017, based on the opinions of mainly North American experts and a review of the literature, are presented in Figure 1.(9)

Performing pre or post-session electrocardiogram is not recommended. Only the threshold of 5 Gy was maintained, which simplifies managing patients on radiotherapy protocol (6).

We report our experience of breast and parietal irradiation in a patient with an intracardiac device. The multidisciplinary collaboration respecting basic rules of radiotherapy and monitoring permitted the safe treatment of our patient.

Considering potential interactions between CIEDs and electromagnetic interference from radiotherapy, updated guidelines are needed. More details about acceptable doses at the different parts of the device are mandatory.

CONCLUSION

Significant CIED complications due to RT are rare. With rising CIED implantation rates, radiation oncology departments likely will be treating an increasing number of patients with CIEDs.A structured multidisciplinary approach to provide specific medical management strategies and to ensure safe and efficient RT delivery. Finally, we highlight the need to develop universal, evidence-based guidelines for managing these patients.

Table 1: The recommendations of the French Society of Radiation Oncology Therapy (SFRO) during radiotherapy treatment

	Dose less than or equal to 2 Gy	For a dose between 2 and 5 Gy
a non-dependent patient: a dependent patient	perform an electrocardiogram before and after the first session, at mid-treatment and at the end of treatment; perform an electrocardiogram after each treatment session;	perform an electrocardiogram before and after the first session of each week and at the end of treatment; perform an electrocardiogram before and after each treatment session;

K: Management of patients with implantable cardiac devices treated with radiation, according to the 2017 consensus of the Heart Rhythm Society. Class of recommendations: Class I (strong): recommended or indicated with high level of benefit; IIa (moderate): reasonable, can be useful; Class IIb (weak): may be reasonable, low level of benefit recommendation; Class III: not recommended, can be harmful, high level of risk recommendation. Level of evidence (LOE: level of evidence): A-NB: high quality evidence based on meta analyses B-NR: Level B, based on observational studies (non-randomized); C-EO: Level C, expert consensus. CIED: cardiac implantable electronic device.

REFERENCES

1. Zaremba T, Jakobsen AR, Søgaard M, Thøgersen AM, Riahi S. Radiotherapy in patients with pacemakers and implantable cardioverter defibrillators: a literature review. Europace. 2016;18; 479-491.
2. Lambert P, Da Costa A, Marcy P-Y, Kreps S, Angellier G, Marcié S, et al. Pacemaker, défibrillateur et radiothérapie: propositions de conduite à tenir en 2010 en fonction du type de stimulateur cardiaque, du pronostic et du site du cancer. Cancer/Radiothérapie. 2011;15; 238-249.
3. Dobson R, Wright DJ. Management of cardiac implantable devices in patients undergoing radiotherapy. Current Problems in Cancer. 2018;42;443-448.
4. Brouillard É, Chamula M, Lavoie C, Varfalvy N, Archambault L. Radiation Therapy–Induced Dysfunction in Cardiovascular Implantable Electronic Devices. Practical Radiation Oncology. 2019;9;266-273.
5. Menard J, Campana F, Kirov KM, Bollet M-A, Dendale R, Fournier-Bidoz N, et al. Radiothérapie pour un cancer du sein et stimulateur cardiaque. Cancer/Radiothérapie. 2011;15:197-201.
6. Huertas A, Thuillot M, Bibault J-E, Sharifzadehgan A, Laurans M, Giraud P, et al. Prise en charge des patients porteurs de stimulateurs cardiaques ou défibrillateurs automatiques implantables traités par irradiation. Cancer/Radiothérapie. 2018;22;515-521.
7. Bitterman DS, Zei PC, Mak RH. Radiation Safety and Cardiovascular Implantable Electronic Devices. International Journal of Radiation Oncology*Biology*Physics. 2018;102;243-246.
8. Yeung C, Chacko S, Glover B, Campbell D, Crystal E, Ben-Dov N, et al. Radiotherapy for Patients with Cardiovascular Implantable Electronic Devices: A Review. Canadian Journal of Cardiology. 2018;34;244-251.
9. Indik JH, Gimbel JR, Abe H, Alkmim-Teixeira R, Birgersdotter-Green U, Clarke GD, 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; e97-e153.