
Purpose: To evaluate the feasibility of using a lead sheet to reduce doses to pacemakers. The efficiency and risk of this type of skin block will be supported by measurements made with an ion chamber and a novel plastic scintillation detector (PSD).

Innovation/Impact: A recent paper [1] suggests reducing radiation doses to pacemakers, but also underlines the difficulty of this task. Our work demonstrates that dose reduction to pacemaker/defibrillator is easily feasible and without risk by using a simple lead sheet wrapped in thermoplastic. Furthermore, the potential of PSD as a high-accuracy and high spatial resolution dosimeter for in vivo measurements is shown.

Methods: A phantom of plastic water compatible at low energies was used. All measurements were made at a depth of 0.5 cm. Measurements were repeated with and without the lead shielding. Irradiations were made using square field sizes of 10, 20 and 30 cm with either antero-posterior (AP) or postero-anterior (PA) beam directions at energy of 6MV and 23MV. Measurements were performed with a parallel plate ion chamber and a PSD.

Results: The mean dose difference between both types of detectors was 0.8% in AP beam direction and 1.2% in PA beam direction at 6 MV. The higher dose difference for PA beams is explained by the lower readings in this configuration, leading to higher measurement uncertainty. Measure in figure 1 show that there are obvious benefits to use a lead shielding. There is a reduction between 40% and 60% of the dose. This benefit is lost when the distance between the field and shielding is more than 35 cm because of the low doses at these distances. When the radiation field overlaps the lead shield, the dose reduction can attain 12%. However, in case were the shielding and the detector are in the field, a dose increase of 96% is measured with a 10 cm square field at 23MV. In PA direction there is no gain to use shielding and the shield can even induce a slight increase in dose.

Conclusion: For AP beam, the shielding can overlap the field but the pacemaker cannot be inside the field. Another recommendation is to avoid using shielding in PA. If there is both AP and PA fields, the shielding can stay on patient for treatment only if the distance between the PA field and shielding is more than 15 cm. The agreement between the PSD and the ion chamber illustrate the potential of PSD for in vivo dose verification of pacemaker doses.

Figure 1: Effect to dose by the presence of shielding for pacemaker measure by ion chamber(IC) and plastic scintillation detector (PSD).

(1) Lamert et al, Cancer/Radiothérapie 15(2011)238-249