The impact of clinical audits on patient radiation exposure for device procedures

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Funding Acknowledgements: Type of funding sources: None.

Background: Clinical audits aim to ensure ideal use of ionizing radiation in clinical practice. Since it became mandatory by Swiss law in 2018, such an audit also took place in our Cardiac Pacing and Electrophysiology Division at the University Heart Center.

Purpose: To establish local diagnostic reference levels (DRLs) for specific procedures and to examine if patient radiation exposure was reduced after the clinical audit.

Methods: Retrospective cohort study including patients from October 2018 to October 2020 who underwent device implantation, including pacemakers, implantable cardioverter defibrillators (ICD), cardiac resynchronization therapy (CRT), or lead extraction / device explantation. Main measures to reduce radiation exposure after the audit were lower pulsed fluoroscopy frame rates and dose characteristics at baseline. Patient radiation exposure was evaluated with the dose-area product (DAP), cumulative dose, fluoroscopy time, and the number of cine acquisitions. Secondary endpoints included the effective dose, the acute procedural success rate and 30-day complications. Data were collected from a dose management system and cross-checked for accuracy with the patient information system. The third quartiles were set as local DRLs. Data before and after the clinical audit were compared.

Results: A total of 541 patients (45.7% before the audit, 54.3% after the audit) were included. 28.3% had a conventional pacemaker, 22.0% a leadless pacemaker, 21.1% an ICD, and 17.2% a CRT implantation. Lead extraction / device explantation was undergone by 11.5% of patients. The local DRLs (including all procedures before and after the audit) for the DAP were significantly lower as compared to national DRLs (6.2 dGy.cm² versus 300 dGy.cm² for conventional pacemakers; 7.6 dGy.cm² versus 200 dGy.cm² for ICDs, 203 dGy.cm² versus 570 dGy.cm² for CRTs). After the audit, DAP (Figure 1), cumulative dose, effective dose and the number of cine acquisition significantly decreased for conventional pacemakers (p-value ≤ 0.04), whereas no significant differences were observed for the other procedures. The acute procedural success rate (98.4 vs 98.9%) and the 30-day complications (4.0 vs 7.8%) were not significantly different before and after the audit.

Conclusions: The clinical audit in our institution led to a significant reduction of radiation exposure for patients during pacemaker implantations. Regarding DRLs, local values were far below national DRLs, which suggests that national DRLs need to be updated more regularly. Our study highlights the importance of clinical audits and the need for more research in this field.
Figure 1: Dose area-product (DAP) for pacemakers before and after the audit