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Development of a Model for Predicting Radiological Risks in Interventional Cardiology

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Abstract : Introduction: During an 'Interventional Radiology (IR)' procedure, the patient's skin-dose may become very high for a burn, necrosis, and ulceration to appear. In order to prevent these deterministic effects, a prediction of the peak skin-dose for the patient is important in order to improve the post-operative care to be given to the patient. The objective of this study is to estimate, before the intervention, the patient dose for 'Chronic Total Occlusion (CTO)' procedures by selecting relevant clinical indicators. Materials and methods: 103 procedures were performed in the 'Interventional Cardiology (IC)' department using a Siemens Artis Zee image intensifier that provides the Air Kerma of each IC exam. Peak Skin Dose (PSD) was measured for each procedure using radiochromic films. Patient parameters such as sex, age, weight, and height were recorded. The complexity index J-CTO score, specific to each intervention, was determined by the cardiologist. A correlation method applied to these indicators allowed to specify their influence on the dose. A predictive model of the dose was created using multiple linear regressions. Results: Out of 103 patients involved in the study, 5 were excluded for clinical reasons and 2 for placement of radiochromic films outside the exposure field. 96 2D-dose maps were finally used. The influencing factors having the highest correlation with the PSD are the patient's diameter and the J-CTO score. The predictive model is based on these parameters. The comparison between estimated and measured skin doses shows an average difference of 0.85 ± 0.55 Gy for doses of less than 6 Gy. The mean difference between air-Kerma and PSD is 1.66 Gy ± 1.16 Gy. Conclusion: Using our developed method, a first estimate of the dose to the skin of the patient is available before the start of the procedure, which helps the cardiologist in carrying out its intervention. This estimation is more accurate than that provided by the Air-Kerma.

Keywords : chronic total occlusion procedures, clinical experimentation, interventional radiology, patient's peak skin dose
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