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The association of CT dosimetric quantities with clinical operational factors: basis for specific optimization strategies

The motivation of this analysis was the knowledge of quantitative association between CT dosimetric quantities and operational factors and devise scanner-specific optimization strategies. The measure of indexes of kerma free in air and in standard phantoms (in a Siemens Sensation CT scanner), provided the main data for identification of statistical associations with operational factors and x-ray spectrum estimation. The association between the CT air kerma index free in air at isocenter, and the x-ray-tube potential, corresponds to a power law function with power coefficients of 1.65 –2.80 in average, for different combinations of tube current time product and total collimation. The average kerma quantity for the periphery of the standard CT dosimetry phantom was linearly associated with the CT air kerma index measured at the center of the same phantom. The linear model parameters were 1.05 and 1.91 in average for standard phantoms with diameters of 160 and 320 mm respectively. The was associated linearly with its primary component, the latter estimated by attenuating the computed primary x ray spectrum, with constant total collimation for each case. The equivalent water diameter estimated was into a range of 67 –75 mm and 136 –144 mm among all operational factor combinations for standard phantoms of 160 and 320 mm respectively. This allows gaining insight into its association with dosimetric quantities for optimization purposes. The descriptive analysis of CT dosimetric quantities and its association with clinical operational factors allows gaining insight in the ability to devise model based optimization strategies.

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