Effective Dose and Size Specific Dose Estimation with and without Tube Current Modulation for Thoracic Computed Tomography Examinations: A Phantom Study

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Abstract : The purpose of this study is to reduce radiation dose for chest CT examination by including Tube Current Modulation (TCM) to a standard CT protocol. A scan of an anthropomorphic male Alderson phantom was performed on a 128-slice scanner. The estimation of effective dose (ED) in both scans with and without mAs modulation was done via multiplication of Dose Length Product (DLP) to a conversion factor. Results were compared to those measured with a CT-Expo software. The size specific dose estimation (SSDE) values were obtained by multiplication of the volume CT dose index (CTDIvol) with a conversion size factor related to the phantom's effective diameter. Objective assessment of image quality was performed with Signal to Noise Ratio (SNR) measurements in phantom. SPSS software was used for data analysis. Results showed including CARE Dose 4D; ED was lowered by 48.35% and 51.51% using DLP and CT-expo, respectively. In addition, ED ranges between 7.01 mSv and 6.6 mSv in case of standard protocol, while it ranges between 3.62 mSv and 3.2 mSv with TCM. Similar results are found for SSDE; dose was higher without TCM of 16.25 mGy and was lower by 48.8% including TCM. The SNR values calculated were significantly different (p=0.03<0.05). The highest one is measured on images acquired with TCM and reconstructed with Filtered back projection (FBP). In conclusion, this study proves the potential of TCM technique in SSDE and ED reduction and in conserving image quality with high diagnostic reference level for thoracic CT examinations.

Keywords : anthropomorphic phantom, computed tomography, CT-expo, radiation dose