The effects of mis-centering on radiation dose during CT head examination: a phantom study.

ABSTRACT

There are several factors that may contribute to the increase in radiation dose of CT including the use of unoptimized protocols and improper scanning technique. In this study, we aim to determine significant impact on radiation dose as a result of mis-centering during CT head examination. The scanning was performed by using Toshiba Aquilion 64 slices multi-detector CT (MDCT) scanner and dose were measured by using calibrated ionization chamber. Two scanning protocols of routine CT head; 120 kVp/ 180 mAs and 100 kVp/ 142 mAs were used represent standard and low dose, respectively. As reference measurement, the dose was first measured on standard cylindrical polymethyl methacrylate (PMMA) phantom that positioned at 104 cm from the floor (reference isocenter). The positions then were varied to simulate mis-centering by 5 cm from isocenter, superiorly and inferiorly at 109 cm, 114 cm, 119 cm, 124 cm and 99 cm, 94 cm, 89 cm, 84 cm, respectively. Scanning parameter and dose information from the console were recorded for the radiation effective dose (E) measurement. The highest mean CTDIvol value for MCS and MCI were 105.06 mGy (at +10 cm) and 105.51 mGy (at - 10 cm), respectively which differed significantly ($p < 0.05$) as compared to the isocenter. There were large significant different ($p < 0.05$) of mean Dose Length Product (DLP) recorded between isocenter to the MCS (85.8 mGy.cm) and MCI (93.1 mGy.cm). As the low dose protocol implemented, the volume CTDI (CTDIvol) were significantly increase ($p < 0.05$) for MCS (at +10 cm) and MCI (at - 10 cm) when compared to the isocenter. The phantom study revealed a noticeable different in radiation dose between isocenter and experimental groups due to degradation of the bowtie filter performance. It is anticipated that these noteworthy findings may emphasize the importance of accurate patient centering at the isocenter of CT gantry, so that CT optimization practice can be achieved.

Keyword : CT dose index; CT head; Mis-centering position; Radiation dose.