

Purpose: To develop pediatric CT protocols by characterizing effects of CT parameters on pediatric CT dose using automatic tube-current modulation (ATCM).

Methods: Sections of varying AP thicknesses (~80, 117, 149, 214mm) from the adult, 10-year-old, 5-year-old, and 1-year-old ATOM phantoms (CIRS, Norfolk, VA) were placed contiguously. They were scanned on a 16-channel CT (Emotion16, Siemens) using ATCM (CareDose4D) to characterize the relationships between image quality and patient-dose under different scan conditions: scan-kVp, adult/pediatric patient selection, and patient size. Effective-mAs/slice was extracted from the DICOM header of each CT image to calculate the DLP/slice. Noise was estimated as the standard deviation in ROIs. Two figures of merit (FOM) were defined: FOM1 as $(\text{noise}^2/\text{DLP})^{-1}$; FOM2 as the $(\text{CNR}^2/\text{DLP})$. Each FOM was calculated for each image of each series acquired.

Results: For scan acquired as pediatric patients, the effective-mAs/slice was lower than the reference-mAs value for patient AP thicknesses below 120 mm but greater above AP thicknesses of 149mm. These differences increased with patient thickness and at lower kVp. For scans acquired as adult patients, the effective-mAs/slice was always lower than the reference-mAs. Under ATCM, the percent difference between the FOM1 for 110 and 80kVp relative to 130kVp ranged from [7,-12]% and [13,-58]% for pediatric, and [3,-16]% and [5,-92]% for adult patients. Under ATCM, the percent difference between the FOM2 for 110 (80)kVp and 130kVp for increasing thickness ranged from 54 to 36 (130 to 78)% for pediatric-entered patients, and 51 to 32 (125 to 43)% for adult entered patients.

Conclusion: CT dose with ATCM decreased for adult-patient and increased for pediatric-patient selection. The AP thickness at which ATCM will use effective-mAs/slice > reference-mAs value for pediatric-patients selection is 120-149mm. Adult -patient selection maintains effective-mAs/slice < reference-mAs value.