Purpose:

Attenuation based Tube Current Modulation (TCM) is used routinely for chest, abdomen, and pelvis CT studies, but is often not used for routine head CT exams. The aim of this study was to determine whether using TCM for routine brain imaging has the potential to reduce CT dose (CTDI).

Methods:

A Toshiba Aquilion ONE CT was used to image a head phantom. Two acquisitions were performed, one fixed tube current scan with 165mAs and one TCM scan with the appropriate SUREExposure SD setting selected to achieve image noise (HU standard deviation) of brain tissue in the posterior fossa region equivalent to that of the fixed tube current scan. Assuming the mA of the fixed tube current scan is limited by the noise level required for the posterior fossa (since posterior fossa is the most challenging head region to image), it is reasonable to assume other regions of the head are receiving unnecessarily low noise levels and can accept further mA reduction; TCM should correct for this. Image noise was measured as average standard deviation of CT number for three ROIs in the posterior fossa and four ROIs in each of two axial locations representing large and small diameter regions. CT dose difference was calculated using scanner reported CTDIvol.

Results:

 Compared to fixed tube current, the TCM scan reduced CT dose by 38%. Compared to fixed tube current, image noise from the TCM scan was equivalent in the posterior fossa region (as designed), nearly equivalent (3% increase) in the large diameter region of the head, and as expected, image noise increased in the smaller diameter brain (24% increase).

Conclusions:

Tube Current Modulation (TCM) has the potential to reduce radiation dose for routine head CT. Future studies will investigate clinical image quality between fixed tube current and TCM head CT scans.

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EA, DZ - Employee Toshiba America Medical Systems, Inc.