Evaluation of image quality vs. radiation dose reduction in coronary CT scans: a 5-year experience

Purpose: Rising concerns over radiation induced carcinogenesis with CT scanning demand dose reduction; however maintaining diagnostic image quality and interpretability is equally important. The aim of this study was to evaluate the diagnostic performance of cardiac CTA during the past five years in our hospital (single source (SS) 64 MDCT, dual source (DS) 64 slice MDCT and DS 128 slice MDCT, Siemens Medical Solutions) in comparison with radiation dose at an academic medical center.

Methods: In an IRB approved, HIPAA compliant, retrospective, single-center, observational study we evaluated the average radiation doses from a large sample (n= 1098, mean age: 59.7 ± 13.4 years) out of a total 5852 consecutive patients referred for EKG-gated coronary CT angiography from January 2005 through May 2010. A retrospective sampling was performed of consecutive patients at 3-month intervals. Image quality was assessed on a per-segment level using a binary scale: (1) diagnostic, (2) non-diagnostic, according to the dictated clinical report. Radiation dose (dose length product- DLP) was recorded from the dose information page and estimated effective dose was calculated (conversion factor k=0.014) for each patient (SS-MDCT, n= 726 patients; 64-DSCT, n= 310; 128-DSCT, n= 62) All CT exams were supervised by a physician, and protocols individually tailored.

Results: The radiation exposure was significantly lower in 2009 compared to 2005 (median effective dose decreased from 14.5 ± SD mSv to 11.6 ± SD mSv; p= 0.035). Further dose reduction of 60% was achieved in the following year: from January 2010 until May 2010, median dose was significantly lower compared to 2009 (6.0 ± SD mSv versus 11.6 ± SD mSv; p< 0.001). Of 18.666 coronary segments, 132 (0.71%) were non-evaluable due to motion artifact (94.7%) and low contrast-to-noise (CNR) ratio (5.3%). The number of non-diagnostic segments decreased by 50% in 2009 (0.8%, n=11) compared to 2005 (1.3%, n=21), although not achieving statistical significance (p= 0.241).

Conclusion: Physician-supervised protocols have showed significant decreases in radiation dose at our institution, but scan quality, as measured by the non-diagnostic segment rate, has been preserved.