

Optimizing radiation dose parameters in MDCT arthrography of the shoulder: illustration of basic concepts in a cadaveric study

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Abstract

Objective: To determine in a cadaveric study the lowest achievable radiation dose and optimal tube potential generating diagnostic image quality in multidetector computed tomography (MDCT) arthrography of the shoulder.

Materials and methods: Six shoulders from three human cadavers were scanned using a 256-MDCT system after intra-articular injection of diluted iodinated contrast material. Using six decreasing radiation dose levels (CTDI_{vol}: 20, 15, 10, 8, 6, and 4 mGy) and for each dose level, four decreasing tube potentials (140, 120, 100, and 80 kVp), image noise and contrast-to-noise ratio (CNR) were measured. Two independent and blinded observers assessed the overall diagnostic image quality, subjective amount of noise, and severity of artifacts according to a four-point scale. Influence of those MDCT data acquisition parameters on objective and subjective image quality was analyzed using the Kruskal-Wallis and Wilcoxon signed-rank tests, and pairwise comparisons were performed.

Results: Multidetector CT protocols with radiation doses of 15 mGy or higher, combined with tube potentials of 100 kVp or higher, were equivalent in CNR to the reference 20 mGy-140 kVp protocol (all $p \geq 0.054$). Above a CTDI_{vol} of 10 mGy and a tube potential of 120 kVp, all protocols generated diagnostic image quality and subjective noise equivalent to the 20 mGy-140 kVp protocol (all $p \geq 0.22$).

Conclusions: Diagnostic image quality in MDCT arthrography of the shoulder can be obtained with a radiation dose of 10 mGy at an optimal tube potential of 120 kVp, corresponding to a reduction of up to 50% compared with standard-dose protocols, and as high as 500% compared with reported protocols in the literature.

Keywords: Arthrography; CT; Image quality; MDCT; Radiation dose; Shoulder.