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CT angiography using lower tube voltage (80 kVp) and moderate concentration of iodine contrast material for imaging the renal arteries: a quantitative and qualitative comparison with conventional CTA

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PURPOSE: To investigate the feasibility of an 80 kVp protocol using a moderate concentration contrast material (MC-CM) for CT angiography of the renal arteries by comparison with a conventional 120 kVp protocol using a high concentration contrast material (HC-CM).

MATERIALS AND METHODS: Attenuation value and SNR were determined in a phantom for 120 kVp with HC-CM and 80 kVp with MC-CM. Among fifty patients, twenty-five patients were scanned with 120 kVp and 200 mAs_{eff} after administration of 110 mL HC-CM (370 mgI/mL), and the other were scanned with 80 kVp and 585 mAs_{eff} after administration of 110 mL MC-CM (300 mgI/mL). The two groups were compared in terms of the arterial attenuation, SNR, CNR, and subjective degree of arterial enhancement and image quality.

RESULTS: Mean attenuation of the main renal artery was significantly higher in the 80 kVp with MC-CM (370.0 $\pm$ 65.0 HU) group than in the 120 kVp with HC-CM (269.9 $\pm$ 27.8 HU, $p < 0.001$) group, without significant differences in SNR and CNR. The 80 kVp protocol had significantly higher quality scores for arterial enhancement, sharpness of the artery, and overall diagnostic image quality compared to the 120 kVp protocol. The effective dose of the 80 kVp protocol (4.5 mSv) was 8.2% lower than that of the 120 kVp protocol (4.9 mSv).

CONCLUSION: The use of 80 kVp with MC-CM could improve arterial enhancement and provide superior image quality with a smaller amount of iodine administration and a lower radiation dose, compared to 120 kVp protocol using HC-CM.