

Ultralow dose non-enhanced CT for urinary stone: added value of adaptive statistical iterative reconstruction (ASIR)

Soo Heui Baek, Seung Ho Kim, Jung-Hee Yoon, Yun-Jung Lim, Choong Ki Eun

Inje University Haeundae Paik Hospital, Korea.

venipion@hanmail.net

PURPOSE: To prospectively evaluate the added value of adaptive statistical iterative reconstruction (ASIR) applied to ultralow dose non-enhanced CT (ULDCT) for detecting renal stone.

MATERIALS AND METHODS: This prospective study received IRB approval and obtained informed consent from all patients. The study was conducted with 114 urinary stones from 48 patients (37 men, 11 women; mean age, 45.7 years; range 19–75 years; mean BMI 24.6 ± 3.9 kg/m²) presenting with acute flank pain. All patients initially underwent non-enhanced CT which consisted of low dose CT (LDCT) (120 kVp, 100 mAs, DLP = 207.54 ± 17.7 mGycm, effective dose = 3.8 mSv) and ultralow dose CT (ULDCT) (120 kVp, 40 mAs, DLP = 83.07 ± 7.07 mGycm, effective dose = 1.2 mSv). The images were reconstructed separately with a 50% ASIR blending ratio. Two blinded radiologists independently performed an interval reading for detection of renal stone per stone basis (size ≥ 1 mm) from ULDCT images to ASIR applied ones, then LDCT images with the same manner, two-weeks apart, respectively. Gold standard was made by other two referees' reading the LDCT images in consensus. For quantitative analysis, CT image noise was measured for each set. Sensitivity for detecting renal stone in each set was compared by McNemar test, and objective noise data were analyzed by paired t-test.

RESULTS: The sensitivity increased from 70% to 80% for reader 1 ($p = 0.001$), from 69% to 82% for reader 2 ($p = 0.001$), after applying ASIR to the ULDCT images. However, when adding ASIR to the LDCT images, the sensitivity was stationary for both readers (reader 1, 87%; reader 2, 89%). The sensitivities of the LDCT was higher than those of the ULDCT for both readers ($p = 0.0078$). Measured CT noises significantly decreased after applying ASIR for both images (for ULDCT, from 40.2 to 27.7, $p < 0.001$; for LDCT, from 25.1 to 17.6, $p < 0.001$).

CONCLUSION: Adding ASIR to the ULDCT images yields improved sensitivity for detection of renal stone, as objective CT noise decreases. However, the application of ASIR to LDCT shows no significant improvement.