Purpose: To compare organ dose, effective dose, and dose conversion coefficients in adult CT estimated using three types of reference phantoms: (1) hermaphrodite mathematical phantom employed by the imPACT CT dose calculator, (2) reference male and female extended cardiac-torso (XCAT) phantoms, and (3) ICRP 110 reference male and female phantoms.

Methods: Representative CT examinations were selected from the database of clinical adult CT protocols in use at our institution. Organ dose, effective dose, and dose conversion coefficients (the k factor) were estimated for these examinations for a clinical CT system (LightSpeed VCT, GE Healthcare) using three methods, each employing a different type of reference phantoms. The first method employed commercial dosimetry software imPACT using Monte Carlo methods for a reference mathematical hermaphrodite phantom. The second and third methods employed a Monte Carlo program previously developed and validated in our laboratory. In the second method, the male and female extended cardiac-torso (XCAT) phantoms created from the Visible Human data were used. In the third method, the ICRP 110 male and female phantoms based on ICRP 89 tomographic anatomic data were used.

Results: The k factor varied very little between phantoms, with average 0.019 mSv/mGy-cm (ranging from 0.009 to 0.025) for imPACT phantom and 0.018 mSv/mGy-cm (ranging from 0.013 to 0.022) for XCAT male phantom. Distributed organs tended to have similar dose values among different phantoms for the same protocol. The calculated percent difference between imPACT and XCAT male phantom was 1.4% for bone marrow and 9.3% for bone surface. Percent differences between phantoms were generally inversely proportional with scan length ranging from 21.1% for chest-abdomen-pelvis protocol to -94% for liver to kidneys protocol.

Conclusions: This work suggests that gender averaged dose from anthropomorphic phantoms should be used as reference to adult patient CT dose.