

Effective dose to patients from thoracic spine examinations with tomosynthesis

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Tomosynthesis, which refers to the principle of collecting low-dose projections of the patient at different angles and using these projections to reconstruct section images of the patient, is an imaging technique recently introduced to healthcare. Phantom evaluations have indicated that the effective dose of a thoracic spine examination using tomosynthesis is about twice the dose from a conventional radiological thoracic spine examination (including four projections), but no detailed description of actual patient doses has been published. The aims of the present work were to calculate the average effective dose to patients from clinical use of tomosynthesis for lateral thoracic spine examinations and to determine a conversion factor between kerma-area product (KAP) and effective dose for the examination.

The GE Discovery XR656 system with VolumeRAD option (GE Healthcare, Chalfont St. Giles, UK) was used to perform thoracic spine tomosynthesis examinations on 17 patients. The examinations included both patients standing up and patients laying down. The recorded dose data consisted of the registered KAP for each of the 60 projection radiographs collected in a tomosynthesis examination and by examining the image data, the field size for each projection radiograph was obtained. These data, together with information of the patient height and weight, were used in the Monte Carlo program PCXMC 2.0 (STUK – Radiation and Nuclear Safety Authority, Helsinki, Finland) to calculate the effective dose for each projection radiograph, using the conversion factors given in ICRP 103. The total effective dose for the tomosynthesis examinations were finally obtained by adding the effective doses from the 60 projection radiographs included in each examination. Based on a comparison between the total registered KAP of the tomosynthesis examination and the calculated effective dose, a conversion factor between total KAP and effective dose was determined.

The results revealed that the mean effective dose for the thoracic spine examinations was 0.47 mSv (range, 0.24-0.81 mSv). Using the mean total KAP of the examinations and the mean calculated effective dose a conversion factor of 0.092 mSv/Gycm² was obtained. The obtained conversion factor agrees well with the conversion factor of 0.091 mSv/Gycm² previously reported for conventional radiological lateral thoracic spine examinations (Wall et al., Report HPA-CRCE-028, Health Protection Agency, UK, 2011).