chamber. The concept of CTDI is still the basis for dosimetry at modern CT scanners, although the assessment of CTDI in phantoms has been the subject of much discussion and many revisions were required since its initial definition. A fundamental revision was for example needed when helical CT was introduced and the concept of pitch had to be taken into account. With the introduction of diagnostic wide CT beams and the introduction of cone beam computed tomography (CBCT) with CT scanners that are integrated with a linear accelerator a new problem arose. For these wide CT beams nor the CT dose phantoms nor the 100 mm long pencil ionization chamber were compatible with the at that time prevailing concept of CTDI. The problem was that the beam width of diagnostic wide beam scanners and CBCT scanners exceeds the length of the cylindrical CT phantoms (typically 150 mm) and length of the pencil CT ionization chamber (100 mm) (Geleijns et al.; Wen et al.). Solution for diagnostics wide cone beam CT scanners

As a development to overcome the shortcomings described in the previous section, the proposed IEC 60601-2-44 international standard (Amendment1 of Edition 3) describes a two tiered approach to the definition of CTDI. The first tier is for beam widths ≤ 40 mm and uses the conventional definition of CTDI100. In the second tier for beam widths > 40 mm, it is proposed to measure a reference value for CTDI in the standard CT dose phantoms, for anamol beam width of about 20 mm. This value is then scaled up by the ratio of free in air measurements of CTDI for the wide beam condition and the reference condition. This approach is also followed in the IAEA Human Health Report 5 and is supported by the scientific work from Boone. Kilovoltage cone beam CT at the linac’s are a special case since at a large field of view the detector is shifted from the centered position, that may complicate the measurements of the CTDI considerably. Assessment of patient dose for cone beam CT scans at the linac’s is also complicated. Monte Carlo calculations or measurements with anthropomorphic phantoms may be performed. A pragmatic approach may be to adhere to the methodology that is often used for diagnostic CT scanners, i.e. to use a body part specific conversion factor for calculating effective dose from dose-length product.

References


The results of the data collection and analysis lead to the following conclusions of the overall total collective effective doses in European countries:

For x-ray procedures in EU-countries and EFTA countries (Norway, Iceland and Switzerland) the collective effective dose is 544700 mSv, or 1,065 mSv per 1000 of population, resulting in a mean effective dose of 1.07 mSv per caput. For all European countries included in the DDM2 survey the collective effective dose was 605010 mSv, or 1,052 mSv per 1000 of population, resulting in a mean effective dose of 1.05 mSv per caput. For NM procedures in EU-countries and EFTA countries the collective effective dose is 30781 mSv, or 60,2 mSv per million of population, resulting in a mean effective dose of 0.060 mSv per caput. For all European countries included in the DDM2 survey the collective effective dose is 31336 mSv, or 54,5 mSv per million of population.