

Creating New Guidelines for CT Patient Doses

B. Højgaard, M. Øberg, H.N. Waltenburg

National Board of Health ▪ National Institute of Radiation Protection (NIRP) ▪ Denmark

Objective

The current national guidelines on diagnostic reference levels (DRLs) and measurement of patient doses in CT are from 2001. They were intended for single slice CT, where the variation in technical parameters of scanning protocols was much more limited compared to multi-slice CT. In order to improve assessment of CT patient doses in Denmark, there was a need for updated guidelines that better reflected current practice.

The guidelines should ensure that enough information is collected to enable NIRP to evaluate differences in patient doses reported for different scanners and from different diagnostic centres. As the use of CT is steadily increasing, and the patient doses are among the highest within X-ray imaging, it is important that there are precise and meaningful DRLs for optimizing CT protocols.



Challenges

Large parts of the collected data were not complete. Weight/height of the patient was missing, or the patient was outside the required weight interval. Also, different scanner protocols were reported in the same worksheet, making comparison difficult. NIRP wants to work out a new worksheet to be used by the clinics to submit data. The new worksheet will contain a number of locked cells to ensure that we only got the relevant data.

New reference levels for DLP and $CTDI_{vol}$ can only be finally determined when sufficient data has been received, collected according to the new guideline.

The chosen CT-examinations, indications and scanner parameters can be found in the near-final version of the guideline – please take a copy if it has caught your interest.

Part of this work was carried out as a Master project of Science and Engineering by Mikkel Øberg at The Technical University of Denmark - DTU.

Changes

| | 2001 guidelines | New guidelines |
|-----------------------------------|-------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| First measurement | | Within 6 months |
| Change in protocol | | New measurement |
| Selection of examinations | Anatomy | Anatomy and indications |
| Measurements | DLP | DLP and $CTDI_{vol}$ |
| Number of patients | 10 | 20 |
| Standard patient | BMI 20-25, weight 70 kg \pm 10 kg | Weight 70 kg \pm 20 kg |
| One clinic - multiple CT scanners | Ten measurements spread out on the different scanners | 20 measurements for each scanner |
| Reporting worksheet | One for each clinic | One for each scanner |
| Other examinations to be included | | The three most used protocols, thereby ensuring measurements on all scanners incl. PET / CT and SPECT / CT |

Method

During the winter 2010-2011 we have collected 6000 patient doses from CT examinations carried out in Denmark. Data from nearly all CT scanners in Denmark were obtained.

In line with the current guidelines the doses were grouped only by anatomical region. The collected data has been analysed, but the distribution of the data shows a significant spread, as each individual category encompass a wide variety of different examination types. The data collected does not represent current practice.

To ensure that the new guidelines will reflect the current use of CT, we have asked for resource persons with experience in CT to assist in the development of new guidelines. Around ten people from different professions (physicists, radiologists and radiographers) have volunteered, and more have offered their opinions on the subject via correspondence with the Institute. Several

New standard patient

The collected data shows that the average patient weight is 74.5 kg. Because NIRP is aware that it has been a big problem for the clinics to find patient in the previously defined weight interval, we now define the standard patient as weighing 70 kg \pm 20 kg.

diagnostic centres have put themselves at disposal for the duration of the trial.

NIRP has developed the basis for new guidelines including 12 types of CT examinations and inquired about the most common indications for these examinations. The proposed guidelines calls for recording of 16 technical parameters in relation to each examination. The resource group has received a web-based questionnaire containing both qualitative and quantitative questions. The answers provided useful input to the new version of the guidelines. A few diagnostic centres ran a pilot project using the new guidelines in order to test the usability and comprehensibility. Unlike the current guidelines, the new ones are based on indications rather than exclusively the anatomical region examined. Patient doses are to be collected for CT, *suspected lung cancer* rather than for the more general CT *lungs*.

For each type of examination, the measurements are to be performed on 20 patients of standard size, and the mean must converge on 70 kg.

