

1. Introduction to Multi Slice Computed Tomography (MSCT)

Historic perspective on the development of MSCT and the growing attention to CT dosimetry

Computed Tomography (CT) was introduced into clinical practice in 1972 and revolutionised x-ray imaging by providing high quality images, which reproduced transverse cross sections of the body. The technique in particular offered improved low contrast resolution for better visualization of soft tissue, but with relatively high absorbed radiation doses. The initial potential of the imaging modality has been realised by rapid technological developments, resulting in a continuing expansion of CT practice, including for example paediatric CT, CT angiography, cardiac CT, CT screening, dynamic CT and CT guided interventional radiology. As a result, the numbers of examinations have increased to the extent that CT has had a substantial impact on not only x-ray imaging but also patient and population exposure from medical x-rays.

The simultaneous introduction in 1998 of computed tomography with multislice acquisition and half-second rotation times allowed major advances in CT imaging. Continuing technical developments have resulted in a reduction of the rotation time to 0.4 seconds and an increase in the number of simultaneously acquired slices to 16. Manufacturers have already announced for late 2004 scanners that can image simultaneously 32-40 slices. Multislice CT (MSCT) with sub-second rotation times allows for the scanning of long ranges (advantageous in, for example, peripheral multislice CTA), for shorter scan times (advantageous in, for example, paediatric CT and trauma), and for a reduction in movement artefacts (as, for example, in ECG gated cardiac CT). With the reconstructed thin axial sections provided by MSCT, a near-isotropic 3-dimensional volume with sub-millimetre sized voxels can be constructed, that is well-suited for review on advanced 3D workstations. This is particularly true for 16 (or more) slice scanners. Review of (often thicker) axial images can be performed in cine mode and in addition sophisticated image reviewing on dedicated workstations allows for e.g. 2D multiplanar and curved planar reformatting (MPR and CPR), maximum intensity projection (MIP) and 3D volume rendering.

Today computed tomography, including MSCT, accounts for nearly 50 % of the resultant collective dose from diagnostic radiology in some countries of the European Union (Brix2003, Brugmans2002, Hart2004). Special measures are consequently required to ensure optimisation of performance in CT, including MSCT, and effective patient protection. The requirement for special attention to radiation protection in computed tomography was formalised in European legislation, which demands that member states pay special attention to radiation protection in computed tomography and in paediatric radiology [CEC1997]. In comparison with conventional computed tomography, acquisition techniques, contrast enhancement and reconstruction

techniques in MSCT are quite different and may affect the levels of image quality and patient dose achieved in practice. There is, therefore, a need to establish quality criteria specifically for MSCT, which provide the required clinical information in its optimal form, with minimum dose to the patient.

Historic perspective on the development of European Quality Criteria for MSCT

The quality criteria concept, as developed for conventional x-ray examinations of adult and paediatric patients and for computed tomography of adult patients by the European Commission's (EC) research actions, has proved to be an effective method for optimising the use of ionising radiation in medical imaging procedures. The purpose of the quality criteria for CT published in 2000 was to provide an operational framework for radiation protection initiatives for this modality, in which technical parameters required for image quality were considered in relation to patient dose. The application of the CT quality criteria has been described by e.g. Calzado (2000), Clarke (2000) and Tsapaki (2001).

A drawback of the publication in the year 2000 is that it deals only with single slice CT scanners. The present document provides an update of the European CT quality criteria for multislice scanners operating with 4 to 16 active acquisition channels.

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Please refer to the quality criteria as:

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