

Radiation exposure in CT: Results of the Swiss survey 2007-2008

R. Treier¹, A. Aroua², A. Stuessi¹, Th. Theiler¹, Ph. R. Trueb¹, F. R. Verdun²

¹Federal Office of Public Health, Bern

²University Institute of Applied Radiation Physics, Lausanne

Email: reto.treier@bag.admin.ch

Introduction

In recent years, the use of computed tomography (CT) in diagnostic radiology has increased rapidly. Compared to conventional X-ray radiography CT results in much higher radiation doses delivered to the patients [1]. While technical advances have improved radiation efficiency, simultaneously there has been pressure to obtain higher-resolution imaging and apply more complex scan techniques, both requiring higher doses of radiation. Although there is no dose limit for patients the law of justification and optimization must be fulfilled. Diagnostic reference levels (DRLs) introduced by the International Commission on Radiation Protection (ICRP) in 1996 provide a valuable means for dose optimization. The aim of this project is to collect dose information of common CT examination protocols for each scanner installed and operated in Swiss hospitals and private radiology institutes and to provide a realistic basis for establishing CT-DRLs in Switzerland.

Material and Methods

Starting at the beginning of 2007, data of craniocerebral, thoracic and abdominal CT examinations was collected for 124 of total 233 CT scanners. Volume computed tomography dose index ($CTDI_{vol}$) and dose-length product (DLP) of the most commonly applied clinical protocols for standard patients was recorded for each examination type. The distribution (mean, standard deviation (SD), minimum, maximum, 25% percentile, 75% percentile) of the $CTDI_{vol}$ and DLP values was calculated and compared to the DRLs based on the Swiss survey in 1998 [2].

Results

Results are summarized in Table 1. The 75 % percentile of the $CTDI_{vol}$ and DLP distribution of the thorax and abdomen are close to corresponding DRLs. For the head, the 75 % percentiles are increased with respect to the DRLs. There is a broad distribution of $CTDI_{vol}$ and DLP values with standard deviations up to 30 % of the mean.

	Head		Thorax		Abdomen	
	$CTDI_{vol}$	DLP	$CTDI_{vol}$	DLP	$CTDI_{vol}$	DLP
Mean	62	949	12	399	14	543
SD	20	328	5	167	5	196
Minimum	34	302	2	86	3	176
Maximum	182	1931	39	945	42	1040
25% percentile	48	718	9	270	11	399
75% percentile	72	1180	15	483	16	675
DRL	60	1000	15	450	15	700

Table 1. Distribution of $CTDI_{vol}$ und DLP values for craniocerebral, thoracic and abdominal CT examinations. Units are in [mGy] and [mGy-cm], respectively.

Discussion

The broad distribution of $CTDI_{vol}$ und DLP values collected in the hospitals and private radiology institutes indicates that DRLs has not yet been correctly applied for CT examinations. Audits and information by the Public Health Authority will help the hospitals and institutes in controlling and optimizing their CT protocols in order to minimize dose delivery to the patients.

References

- [1] Aroua A.; Burnand B.; Decka I.; Vader J.P.; Valley J.F.: Nation-wide survey on radiation doses in diagnostic and interventional radiology in Switzerland 1998. Health Phys. Vol. 83, No. 1, 2002, p. 46-55.
- [2] Aroua A.; Besançon A.; Buchillier-Decka I.; Valley J.F.; Verdun F.R.: Niveaux de reference diagnostiques (NRD) pour la radiologie diagnostique et interventionelle en Suisse. Rapport interne IRA, 2002.