Bundesamt für Strahlenschutz

FREQUENCY AND EFFECTIVE DOSE OF DIAGNOSTIC AND INTERVENTIONAL X-RAY PROCEDURES IN GERMANY

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Aim

The aims were (1) to collect and evaluate data for medical radiation exposure due to diagnostic and interventional X-ray procedures conducted in Germany during 1996 and 2003, and (2) to perform a trend analysis. These data serve, inter alia, for the optimisation of radiation protection.

Materials and Methods

Information on annual frequencies of diagnostic and interventional X-ray procedures was for the most part obtained from German health insurance companies via codes from reimbursement catalogues. The codes were arranged according to the type of diagnostic procedure and/or region of examination. To achieve a standardisation, 19 categories were created in total.

The effective doses of the various types of examinations were taken from research projects, the current literature (e.g. [1], [2]), and a recent nation-wide survey on computed tomography (CT) practice [3]. Moreover, random samples of measurements in hospitals and medical practices, performed by the Federal Office for Radiation Protection, were included. From frequency data and dose estimates the collective effective dose and the effective dose per inhabitant were estimated.

Beware of the fact that systematic errors cannot be completely avoided, a standardised method of data assessment has been developed to permit a consistent evaluation of time series and thus a trend analysis. This method aims at keeping systematic errors at least constant in order to be able to recognise trends as early and as reliable as possible.

Results

Compared to other industrialised countries, Germany is positioned in the upper range with about 1.7 X-ray examinations per inhabitant in the year 2003 (Figure 1). On the one hand, the overall frequency of X-ray examinations decreases during the period 1996 to 2003. On the other hand, the mean effective dose per capita shows an increase from about 1.6 mSv in 1996 to about 1.7 mSv in 2003 (Figure 2). This rise can mainly be attributed to the increased application of CT. CT contributes about half of the total cumulative effective dose in 2003 despite the fact that it contributes only about 6% to overall X-ray procedures (Figure 3).

In contrast to CT examinations, the number of conventional X-ray examinations of the chest and of the abdomen (including digestive, bile and urogenital tract) is decreasing. Dental X-ray diagnostics account constantly for about one third of the total number of X-ray examinations. Apart from dental X-ray examinations, X-ray examinations of the skeleton (i.e. head, shoulder, spine, pelvis/hip, extremities) and of the thorax are the most frequent (Figure 3).

Discussion

Increases in the collective effective dose resulting from X-ray examinations are observed in many industrialised countries, reflecting the increasing importance of diagnostic imaging procedures and the increasing use of new diagnostic techniques. In view of this trend, optimisation of radiation protection for patients is becoming increasingly important. Rising applications of new radiological technologies, e.g. multislice CT, should be associated with strict considerations concerning their justification.

[1] Hart D, Jones DG, Wall BF: Estimation of effective dose in diagnostic radiology from entrance surface dose and dose-area product measurements, Report NRPB-R262, London, 1994

[2] Drexler G, Panzer W, Widenmann L, Williams G, Zankl M: The calculation of dose from external photon exposures using reference human phantoms and Monte Carlo methods, Part III: Organ doses in X-ray diagnosis. GSF-Bericht 11/90, Neuherberg, 1990

[3] Galanski M, Nagel HD, Stamm G: CT-Expositionspraxis in der Bundesrepublik Deutschland. Fortschr Röntgenstr 173: R1-R66, 2001

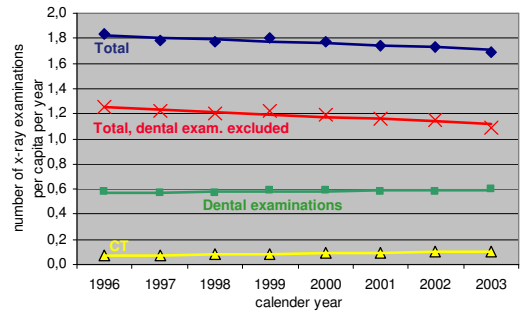

Figure 1: Annual number of medical and dental X-ray examinations per inhabitant in Germany for the years 1996 to 2003.

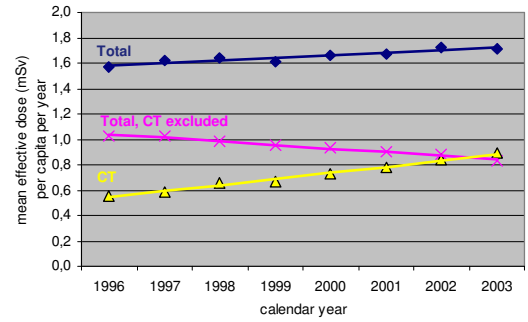

Figure 2: Effective dose (mSv) per inhabitant per year due to X-ray diagnostics in Germany for the years 1996 to 2003.

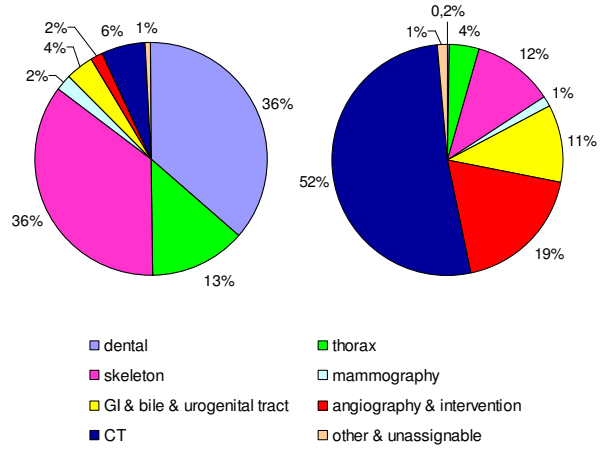

Figure 3: Relative frequencies (left panel) of various examination types and their contribution to the collective effective dose from diagnostic radiology (right panel) in 2003.