

Diagnostic Reference Levels (DRLs) in projection radiography

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Introduction

Standard radiology procedures in projection radiography (plain film or digital equipment) account for 48% of the total number of examinations and contribute 41% to the collective dose [1]. This implies that justification and optimization is not only important for high-dose applications like computed tomography or fluoroscopy but also for projection radiography. One of the main targets with the introduction of the DRL concept is to investigate situation levels, where patient doses are unusually high. Thus, DRLs provide a valuable method for dose optimization processes [2]. With the aim to establish and ‘familiarize’ the published reference values and to customize them into national DRLs, a nationwide survey of applied patient dose in projection radiography was performed.

Material and Methods

The quantity of interest in routine measurements of the patient dose in projection radiography is the Entrance Surface Dose (ESD). 40 private radiology institutes and hospital radiology departments evenly distributed across Switzerland were involved in the survey. Because plain film radiography has fully been replaced by digital radiography systems, the scope of the units was limited to non film-screen equipment (CR or DR). – For each institute, three types of common radiographs were evaluated (chest, lumbar spine and pelvis in ap or pa projection). First, the local tube output (empirically determined constant) of the unit was calculated by determining the Entrance Surface Air Kerma (ESAK), using the equation for estimating the ESD [3]. Thereafter, the ESD was calculated for standard patients by applying the used exposition parameters kV, mAs and focus-skin-distance. A well accepted backscatter factor (BSF) of 1.35 [1, 4] was applied in the equation. The distribution of the ESD values (mean, minimum, maximum, standard deviation (SD), 25th percentile, 75th percentile) was calculated for each unit and examination and compared to the current published DRLs, which are based on the European directive [3, 5]. National DRLs will subsequently be adapted, if necessary.

Results

So far, data of 17 of total 40 institutes were analysed. These preliminary results show that the derived ESD values are far below the existing DRLs. For the chest region, the 75th percentile of the ESD distribution amounts 0.12 mGy (42 % of the DRL which is 0.3 mGy). For the pelvis, the calculated 75th percentile of the ESD distribution is 2.51 mGy (25 % of 10 mGy) and the lumbar spine shows a 75th percentile of 5.19 mGy (52 % of 10 mGy). The complete analysis and an international comparison of DRLs in common radiography [6] is in progress and will be published.

Discussion

One of the reasons for the remarkably lower values in this survey compared to the existing DRLs may be due to the high optimization potential of digital imaging (particularly with direct radiography (DR) systems). According to the actual analysis, the results will allow to adapt the national diagnostic reference levels by a reduction factor of 2 (chest, lumbar spine) and even by a factor of 4 (pelvis).

References

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