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Under the microscope

Study of image quality and dose values for thorax images with the DX-D 300 and MUSICA 3 by PD Dr Karina Hofmann-Preiss, Institute of Imaging Diagnostics and Therapy (BDT), Erlangen

Agfa HealthCare's DX-D 300 digital U-arm system has been in use at the Waldkrankenhaus St. Marien healthcare center since May 2013. Radiologist Dr Karina Hofmann-Preiss and her team attach great importance to patient comfort and high image quality as well as the minimization of radiation exposure. For Dr Hofmann-Preiss, the DX-D 300 kills two birds with one stone. "We get higher-quality and more diagnostically meaningful images with a lower radiation dose." The high image quality of the DX-D 300 was achieved primarily by the cesium iodide detector and the MUSICA image processing software. In fall 2013 it was still unclear what dose reduction the radiologists at the Institute of Imaging Diagnostics and Therapy (BDT) would ultimately be able to achieve during individual examinations, as some assessments of the individual examinations still remained to be carried out. At that time it was estimated that the dose could be reduced by at least 15% compared with the previously used imaging plate systems.

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In May 2014, the DX-D 300 was equipped with MUSICA 3, the next, further optimized generation of the image processing software. To collect reliable information about the dose and image quality with MUSICA 3, thorax X-rays were evaluated for a period of five weeks after the software was installed.

Scope of study

A total of 354 patients participated in the study, with an age range of 17 to 94 (Fig. 1). Examinations were carried out on 190 male patients and 164 female patients. In 74 cases only PA images were taken and in 280 cases two-plane images. The exposure parameters were 117 kV for PA, 125 kV for lateral X-rays with automatic exposure, anti-scatter grid r = 8:1, f0 = 180 cm, 52 L/cm.

The dose area products of all examinations were calculated in cGy x cm² and the effective dose for the individual X-ray was estimated from this using the conversion factor (0.002). The BMI was calculated for 275 patients from this collective and was between 18 and 44 (Fig. 2).

Initial results

For both the PA and lateral images, the dose area products for all BMI values were clearly below the current German dose reference value of 16 cGy x cm² or 55 cGy x cm² for lateral images. The average dose area product for PA images in this collective was 6.44 cGy x cm² and for lateral images was 16.01 cGy x cm² (Figs. 3 and 4). The average effective dose for a PA thorax X-ray in the collective was 0.013 mSv and for a two-plane X-ray was 0.046 mSv.

The lowest dose area product with a BMI of 18 was 3.1 for PA and 5.02 cGy x cm² for lateral. In this case the effective dose for the complete examination was 0.016 mSv. The maximum dose area product for a PA image was 14.7 cGy x cm², and correspondingly the dose area product for a lateral image in this case was 36.3 cGy x cm². Here the effective dose was 0.1 mSv for the complete examination.

The image quality was assessed in line with the quality requirements of the guidelines published by the Bundesärztekammer on quality assurance in diagnostic radiology.

Conclusion

Even at a very high BMI there were no limitations on the representation of characteristic features, important details or critical structures.

Both the retrocardiac lung and the mediastinal structures can be well assessed even with very overweight patients (Fig. 5 and 6).

In particular, the retrocardiac lunge and the mediastinal structures were easier to assess in an intra-individual comparison between MUSICA² and MUSICA 3.

Sources

German Federal Office for Radiation Protection; Announcement of updated diagnostic reference values for diagnostic and interventional X-ray examinations, 07.22.2010

Bundesärztekammer; Guidelines on quality assurance in diagnostic radiology – Quality criteria for diagnostic X-ray examinations, 11.23.2007

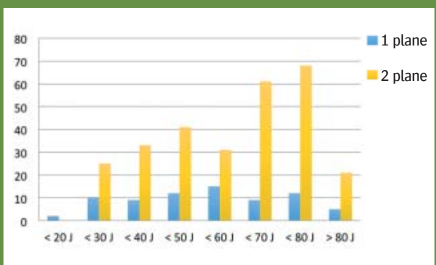

Fig. 1 **Age distribution for thorax images**

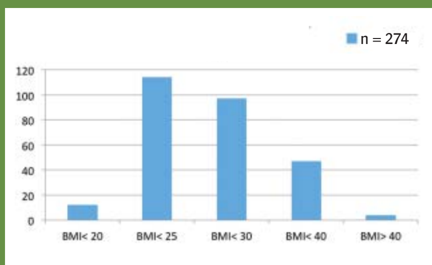

Fig. 2 **Distribution of BMI in the collective**

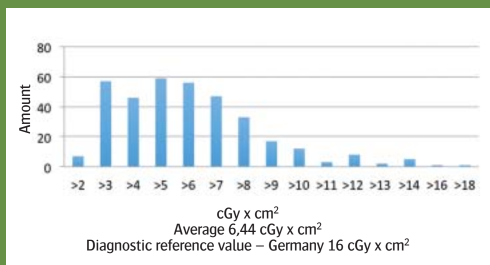

Fig. 3 **Dose area product for thorax (PA)**

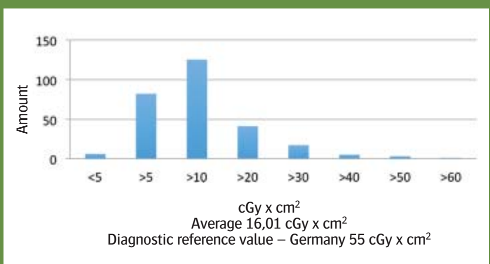

Fig. 4 **Dose area product for thorax (LAT)**

Fig. 5 **BMI: 18, DAP PA 3.1 cGy x cm²**
effective dose including lateral image: 0.01 mSv

Fig. 6 **BMI: 43.8, DAP PA 14.7 cGy x cm²**
effective dose including lateral image: 0.1 mSv

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