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Assessment of scatter radiation in the shielding of radiography procedures

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Purpose

Scattered radiation is the largest contributor to patient dose and the main cause for stochastic effects (1-3). Evaluate the use of radiological protections and attenuating materials depending on the scattered radiation which the patient is subject, analyzing the appropriate placement of the protections is extremely important for the improvement of the radiographer clinical practice (4-7). Therefore, the purpose of this research is to ascertain the best way to protect irradiated patients, particularly children and pregnant women.

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Methods and materials

This study used several instruments, namely: Two ionization chambers, one flat and one pencil type; PTW United E electrometer; Atomtex brand dosimeter, model AT1123 Medical ECONET portable X-ray equipment, model meX+100; Anti-scatter grid Gypsum board with barium sulfate (12 mm thick); Lead plate (3 mm thick); Lead apron (with an equivalent thickness of 0.25 mm); Lead collar for thyroid protection (with an equivalent thickness of 0.5 mm); Water phantom (23 cm thick); Polymethylmethacrylate (PMMA) cylindrical phantom. In order to verify the influence of scattered radiation...

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Results

Through the exposures performed, results were obtained regarding the dose at the entrance surface of the beam in the phantom, the dose at the posterior surface of the phantom, the absorbed dose, the flow rate equivalent to the ambient dose and the dose in the air (scattered radiation present in the air). Backscatter using materials Figure 3 show the results related to the measurement of the backscatter of materials used. A dose of 18 µGy was obtained by exposing only the wall. It was found...

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Conclusion

The materials with less backscatter was the anti-diffusion grid and the lead plate. We observed that the scattered radiation does not influence the dose at the entrance of the phantom when the attenuating materials were placed on the posterior surface of the phantom, influencing only the dose at the exit. The greater dose reduction was observed when the protection was placed around the phantom. Therefore, in the presence of scattered radiation, the anti-diffusion grid and lead shields must be used, and it is necessary to...

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Personal information and conflict of interest

M. Duarte: Nothing to disclose S. I. Rodrigues: Nothing to disclose L. P. V. Ribeiro: Nothing to disclose A. F. C. L. Abrantes: Nothing to disclose R. P. P. Almeida: Nothing to disclose K. B. Azevedo: Nothing to disclose A. d. M. Ribeiro: Nothing to disclose

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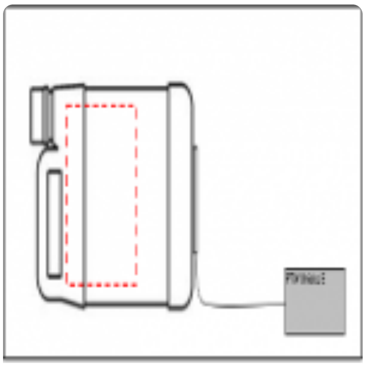

Fig 1: *Mesurement of the absorbed dose without protection*

Fig 2: *Mesurement of the absorbed dose with lead protection around the phantom.*

	Dose in the air (µGy)
Wall	18
Anti-scatter grid	15,8
Anti-scatter grid + lead plate	15,4
Anti-scatter grid + barium sulfate plate	15,8
Lead plate	18,4
Barium sulfate plate	20,4

Fig 3: *Backscatter of different materials*

	Dose at the entrance of the phantom (µGy)
Phantom + Wall	33,6
Phantom + Anti-scatter grid	33,9
Phantom + Anti-scatter grid + barium sulfate plate	33,6
Phantom + Anti-scatter grid + lead plate	33,6
Phantom + lead collar	17,9

Fig 4: *Results of measurements of the dose at the entrance of the PMMA cylindrical...*

	Dose at the exit of the phantom (µGy)
Phantom + Wall	11,6
Phantom + Anti-scatter grid	11
Phantom + Anti-scatter grid + barium sulfate plate	10,6
Phantom + Anti-scatter grid + lead plate	10,6
Phantom + lead collar	10,3

Fig 5: *Results of measurements of the dose at the exit of the PMMA cylindrical phantom...*