DETERMINATION OF THE RADIATION DOSE IN THE OPERATOR POSITION IN MAMMOGRAPHY EQUIPMENT

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Abstract

Evaluation of the radiation dose given to the patients and workers in mammography are very important to protect them of the deleterious effects of ionizing radiation.
The objective of this paper is performs measurements to determine the dose in the mammography equipment operator, behind the safety glass (in the panel control position). After that initial procedures it will be realized the evaluation if the lead glass is effective for a protective barrier against scattered radiation emitted during a calibration and examination routines, or if it is required another form of physical protection for the workers in mammographic equipment.

Keywords: Mammographic equipment; Radiation dose: Radioprotection; X-ray beam

Introduction

The use of X-rays beams for use in diagnostic radiology is very common and important to Medicine, including mammographic diagnosis.

Evaluation of the radiation dose given to the patients and workers are very important to protect them of the deleterious effects of ionizing radiation.

The Instruments Calibration Laboratory (LCI) of the IPEN-CNEN/SP performs for many years the calibration of the dosimeters (using standard X-ray beams) applied in radiation dosimetry (in diagnostic radiology). The objective of this paper is performs measurements to determine the dose in the mammography equipment (VMI Graph Mammo AF Philips) operator, behind the safety glass (in the panel control position).

The Resolution SS-625 of 12/14/94 (Brazil)[1], explain the location of the control of x-ray equipment, including mammography. It's say:

"When the control desk of the X-ray fixed, nominal voltage equal to or less than 125 kV apparatus is situated within the X-ray room, there must be a fixed protective screen provided to the operator display lead fixed glass, or other display system of the patient, allowing the technician in the firing position, view the patient and guaranteeing the maintenance of the dose limits specified in this technical Standard. "

Due to the particularities of mammography, as the breast compression, it is necessary that the equipment operator remains in the room where the patient. It is noteworthy that in mammography, the voltage used is low (below 125 kV), which would not justify a table of command outside of the exam room.

In this study, we sought to measure the radiation that passes through the lead glass, taking into account an operator that performs mammography averaged 40 exposures technique of 28 kV and 100 mAs per day, and also an employee of the

calibration laboratory, which performs average of 100 daily treatments with technique of 28 kV and 200 mAs.

Materials and methods

The mammographic equipment was used for exposures was Philips mammography-VMI, Graph Mammo AF, which operates in a range 20-35 kV, has target of molybdenum and molybdenum and rhodium filters. His lead glass has 102mm of thickness, 55cm of width and 206cm of high.

For measurements, was used the Radcal model 9015, collector dosage, used in conjunction with the ionization chamber Radcal 10X5 180cc.

The ionization chamber was placed before the lead glass to collect the radiation that reaches the bulkhead lead. Was positioned at the height of 158cm an 20cm directed to the position of equipment operator.

Five exposures with 28 kV and 100 mAs (operator exams), and then five exposures with 28 kV and 200 mAs (instrument calibration) were performed. The average of these five consecutive exposures were used for the calculations, like the table 1 shows:

Lecture	**Temperature**	**Pression**	**Lecture corrected**
nGy	**(º C)**	**(mbar)**	**nGy**
228	24,4	932,7	291,100
252	24,4	932,7	321,742
210	24,4	932,7	268,118
210	24,4	932,7	268,118
220	24,4	932,7	280,886

Table 1: Five consecutives exposures with 28 kV and 100 mAs and his average.

Then, the ionization chamber was positioned behind the lead glass to measure the radiation that exceeded the barrier. The chamber was positioned with the same previous parameters, 158cm of height and 20cm directed to the position of operator.

Results

In the measurements with the closest used in mammographic technique, and with the ionization chamber before the lead glass, we obtained an average of 286 nanograys (nGy), with the lowest dose at 268 nGy and the largest in 322 nGy. With the camera positioned after the lead glass, the average collected was 34 nGy doses, the largest dose 38 nGy, and the lower 30 nGy.

In the measurements with the technique used in calibrations, with the ionization chamber before the lead glass, we obtained an average of 536 nGy, with the smallest dose 529 nGy, and the largest 552 nGy. With the camera positioned after the lead glass, the average collected was 44 nGy doses, the largest dose 54 nGy, and the lower 38 nGy. Table 2 shows the results obtained:

Comparative dose collected in average exposure situation and laboratory exposure before and after the shield Pb		
	Before the lead glass	After the lead glass
Dose collected for clinic / hospital worker (nGy)	286	34
Dose collected for calibration laboratory worker (nGy)	536	44

Table 2: Comparison of the dose collected at the medical exposure position and laboratory exposure before and after the lead glass.

It is interesting to note that with the use of high mAs technique, as in the situation of calibration in the laboratory, the dose before the glass increased proportionally to the mAs in charge of equipment (100 mAs dose was 286 nGy. And 200 mAs, 536 nGy), but the dose that exceeds the glass does not accompany the increase in mAs in charge (34 nGy to 100 mAs and 44 nGy to 200 mAs).

In the case of a worker in laboratory instrumentation, the dose received is greater than the worker in the medical area due to the amount of reallizadas exposures.
Working with the assumption that the operator performs mammography examinations to physicians on average 40 exposures, the dose received would nGy 1,360 in a day, while the worker in the laboratory performs on average 100 exhibitions, receiving a dose of 4,400 nGy in one day.

Conclusions

The glass used in mammography plumbífero IMV Graph Mammo AF LCI is effective for the radioprotection of the worker instrument calibration, even with a high amount of daily exposures, since the increase of the control but in the mammography results in a higher amount of radiation but does not increase its penetration power, which would only be possible with increased kV (kilovoltage). If this same equipment is used to perform medical examinations, would also be within the standards prescribed in the radiological protection, and the exposure limit of 20 mSv / ano² for IOE (Individual Occupationally Exposed).

References

1. Resolution SS-625, of 14.12.94 published in DOE; section i; Sao Paulo - 14/12/94

2. International Atomic Energy Agency. Occupational Radiation Protection – Safety Standards Series N° RS-g-1.1 – Vienna, 1999