Assessment of scatter radiation dose received by comforters and carers during digital breast tomosynthesis mammography

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Background

Patients may require comforters or carers to remain in the room during digital breast tomosynthesis for physical and emotional support.

Comforters and carers (C&C) are exposed to ionising radiation while providing support for patients during medical examinations.

The Australian Radiation Protection and Nuclear Safety Agency recommend 1 mSv per diagnostic radiological examination (1), aiming to reduce risks and potential harm due to radiation exposure.

Limited evidence is available stating the radiation dose received during a digital breast tomosynthesis (DBT) examination.

Aims

To determine the optimal position for comforters and carers to stand during digital breast tomosynthesis.

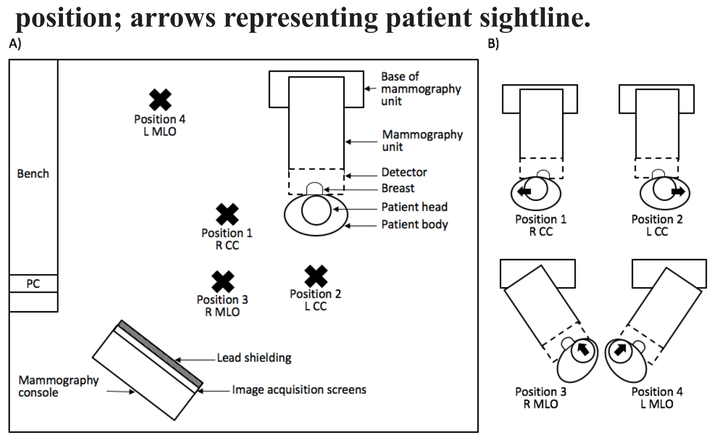
The study can be used as a reference to determine the optimal standing position for C&C. Additionally, it informs mammography staff with evidence based data about the C&C radiation dose received. This is preferable to the current arbitrary definition of receiving a ‘very low dose’ and effectively communicates radiation risk.

Method

A Hologic Selenia Dimensions (Danbury, USA) mammography system was used for imaging. The scatter detector used was a Step OD-02 Survey Meter (2). Phantom measurements were also taken, with the phantom thicknesses matched to exposures for the patient equivalent breast thickness.

The scatter detector was placed at four different positions during imaging, (Fig 1), with a maximum of four measurements per patient.

Fig: 1: (A) Scatter detector positions. (B) Patient position; arrows representing patient sightline.



Results

Median scatter air kerma for craniocaudal views for C&C standing posterior and to either side of the patient are 0.75 µGy and 10.1 µGy respectively. Median scatter air kerma for mediolateral oblique views for C&C standing in the posterolateral position (position 4) versus anterolateral (position 3) are 0.41 µGy and 2.6 µGy respectively; over 6 times lower (Fig 2).

Fig 3. demonstrates scatter dose versus breast thicknesses and density. No significant correlation between breast density and scattered radiation was found.

Fig 2: Boxplots of the scatter radiation measured at each position.

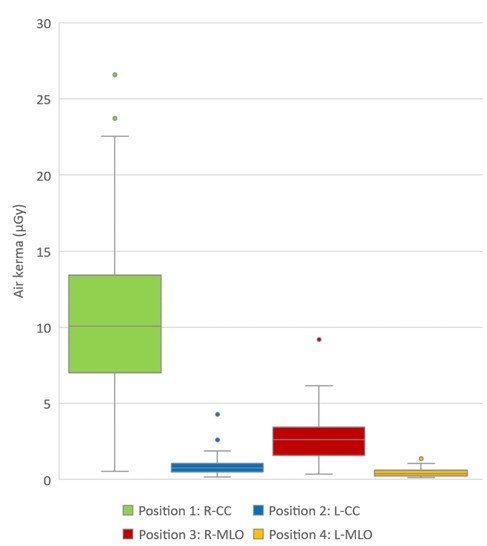
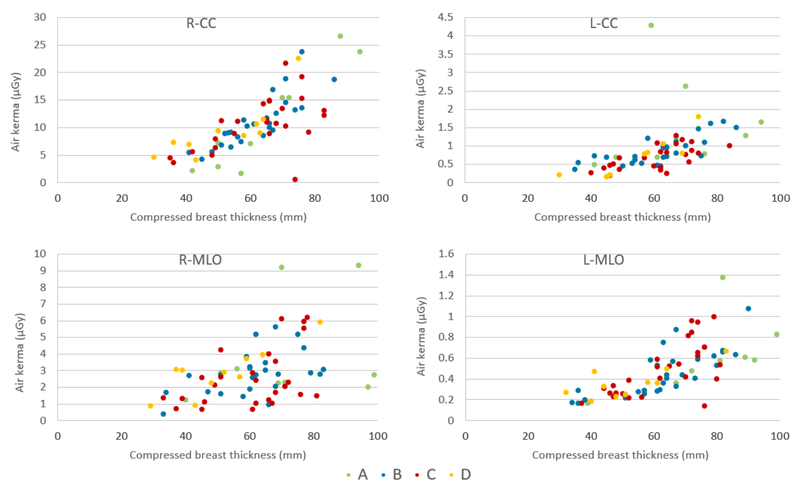


Fig 3: Radiation scatter vs breast thickness. Density as per BI-RADS classification (3)



Conclusion

C&C should stand posterior to the patient for either craniocaudal view and posterolateral to the breast being imaged for mediolateral oblique views to receive the lowest scatter radiation dose.

Position 2 and 4 are optimal if a C&C is needed during DBT imaging, resulting in a total dose of 2.3 µSv for a median compressed breast thickness. The average daily exposure to natural background radiation in Australia is equivalent to approximately 5 µSv (4). In comparison, standing in suboptimal positions 1 and 3 will receive a total of 25 µSv from a median compressed breast thickness; approximately 5 times the Australian natural daily background level.

Of importance, all radiation values measured are below the ARPANSA 1 mSv C&C dose constraint (1).

References

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