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NICU Next-Bed Exposure

Safe to stay within the room during bedside X-Ray?

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Introduction

Diagnostic radiology or X-Ray is increasingly carried out in the assessment and treatment of infants requiring intensive care.

Background

In the Neonatal Intensive Care Unit (NICU), infants are often exposed at patient's bedside to a large number of radiographic examinations. Healthcare personnel and family caregivers would either leave the room or chose to stand at least 2 to 3 meters away whenever an X-Ray is made. Caregivers raised concerns on the risk of their infants being exposed to any scatter radiation when X-ray are repeatedly performed within the room for another patient. Would their infants be overly exposed and are there any risks with the frequent number of X-Ray exposures?

Objective

To provide information about the scatter radiation exposure level between patients and to conclude if current setting is safe when performing bedside X-ray within the room.

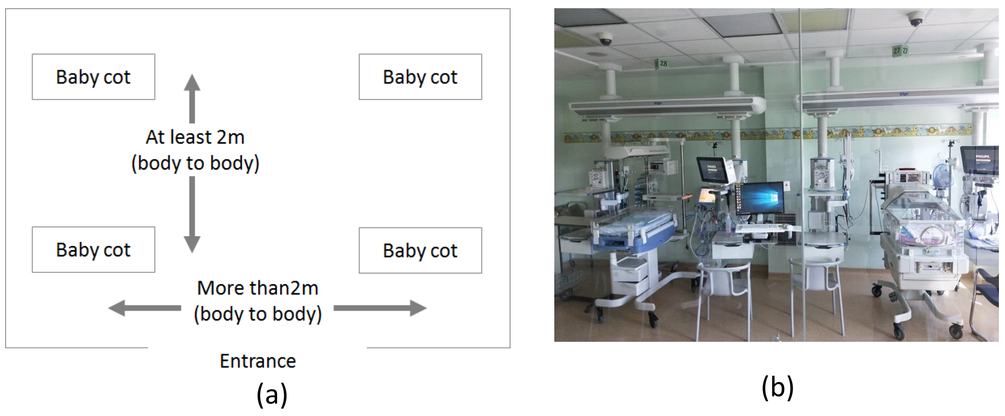

Figure 1 (a) and (b): Configuration of the neonatal cots in a typical NICU room setting.

Methodology

This study was conducted at the procedure room in the NICU. All exposure are executed in the Antero-Posterior (AP) projection, the X-Ray beam was directed perpendicular to the floor and the dose meters were placed adjacent to the cot (Fig 2a &b). Perspex blocks equivalent of 10 cm thickness was use to simulate the size of the infant and exposure parameters (62kVp, 1mAs at 100cm SID) were used .

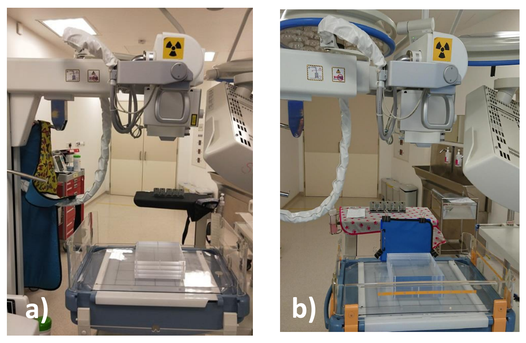

Figure 2 a) and b):
All exposure are performed with the Philips MobileDiagnost wDR mobile X-ray machine. Perspex (25cm × 25xm × 2.5cm, 4 pieces) and lead were as used as the phantom and the shielding material respectively.

Figure 3: Materials that are readily available to be used as shielding materials: plywood (29.5cm × 21cm × 4.8cm, 4 pieces), paper (1 ream of A4 size), perspex 25cm × 25xm × 2.5cm), and lead (from old lead apron, 0.5mm lead equivalent at 100kV X-ray). These materials were characterized using X-ray spectrums that are used clinically (60kV, 62kV, and 65kV) with Unfors Xi X-ray meter.

Figure 4: Radiation levels at 1m and 1.5m were measured using Thermo Mk2 electronic personal dose meters. These meters were calibrated to measure body dose in units of Sieverts. 5 dose meters were used for each distance and material.

Result

In the initial trials (Fig 5), lead (as expected) interacts strongly with X-Ray; paper interacts more strongly than perspex, and plywood has the least interaction. Air was assumed to have no interaction with X-Ray.

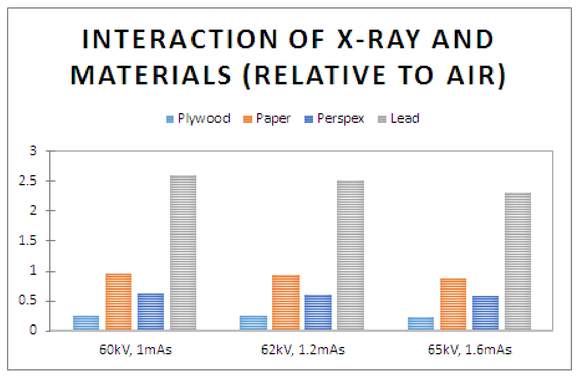

Figure 5: Shielding materials (plywood, paper, perspex, and lead) were characterized by measuring attenuated X-Ray intensity that are used clinically, i.e, 60kV, 62kV, and 65kV.

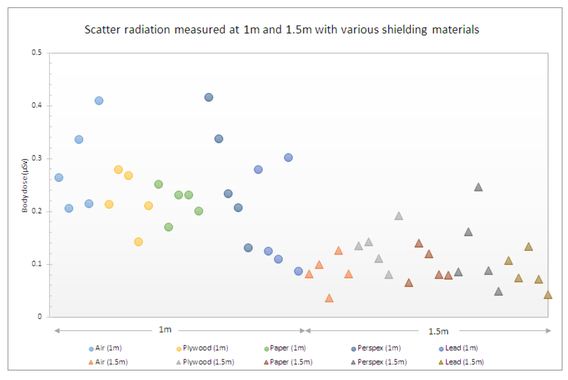

Figure 6: Measurement of scatter radiation in terms of body dose at 1m and 1.5m using various shielding materials. See Section Methodology for details.

In the actual study (Fig 6) at 1m, body dose measured using lead as shielding material was slightly lower than plywood, paper, and perspex. A slight increased in body dose was measured using perspex due to the additional scatter radiation produced by perspex.
At 1.5m, body doses measured were basically background radiation across all materials, despite a slight increased in readings due to scatter in perspex.

Conclusion

At 1m and 1.5m, radiation levels measured were basically background radiation and hence, current practice at NICU produce no scatter radiation nor harmful effect on other infants within the room.