A New Device to Markedly Reduce Cardiac Cath Lab Radiation Levels

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Background: Exposure of the heart team to scatter radiation is a serious environmental risk in the cardiac cath lab. While spot shielding reduces operator exposure, its effectiveness in reducing overall room scatter radiation (SR) levels, particularly during imaging with angulated x-ray views, is limited.   We evaluated the effectiveness of a new, passive protection system (the EggNest) to reduce overall personnel exposure using x-ray projections commonly used for coronary and structural heart procedures. The system is composed of a carbon fiber sled that replaces the x-ray table patient mattress in combination with radiation shielding that moves passively with the x-ray system and the patient.

Methods: SR measurements were taken at six positions around an anthropomorphic human shape phantom (US DOE) imaged using 70keV, 15 f/s fluoroscopy. SR was measured from 20 cm to 200 cm above the floor with no shielding, typical shielding (table skirt and hanging shield, both 0.5mm Pb), and the EggNest shielding platform. All measurements were taken with each shielding condition in 5 typical angiographic projections. We developed an index of Total Room SR by summing the SR values for each position and height around the table.

Results: Total Room SR varied markedly with x-ray angulation (Table 1).   Standard shielding reduced Total Room SR slightly. In contrast, the EggNest markedly reduced Total Room SR in all angiographic angles tested (average 92% reduction). In comparison with standard shielding, the EggNest significantly reduced SR exposure at all 6 positions around the table in each angulation (Table 2).

Table 1: Total Room SR (µSv/h)	PA	RAO30 Caud20	RAO 30 Cran30	LAO40 Cran30	LAO40 Caud30
No Shielding	10010	24540	13910	20850	38910
Standard Shielding	7910	23230	12330	17960	34870
EggNest	640	2670	1210	1110	2040

Table 2	Reduction in SR with the EggNest Compared to Standard Shielding					
Values for all heights, summed	PA	RAO30 Cuad20	RAO30 Cran20	LAO40 Cran30	LA040 Caud30	Position Average
Left shoulder- Echo	-97%	-87%	-91%	-94%	-90%	**-92%**
Right shoulder- RHC	-89%	-81%	-87%	-94%	-95%	**-89%**
Right chest	-92%	-94%	-93%	-97%	-95%	**-94%**
Operator- radial/femoral access	-90%	-98%	-90%	-73%	-94%	**-89%**
Assistant	-82%	-80%	-72%	-48%	-95%	**-75%**
Nurse 1.5 m from table	-92%	-91%	-93%	-95%	-98%	**-94%**
Total Room SR	**-92%**	**-88%**	**-90%**	**-94%**	**-94%**	**-92%**

Conclusion: The EggNest system markedly reduces Total Room SR around the CCL table for the angled views typically used for cardiac applications.