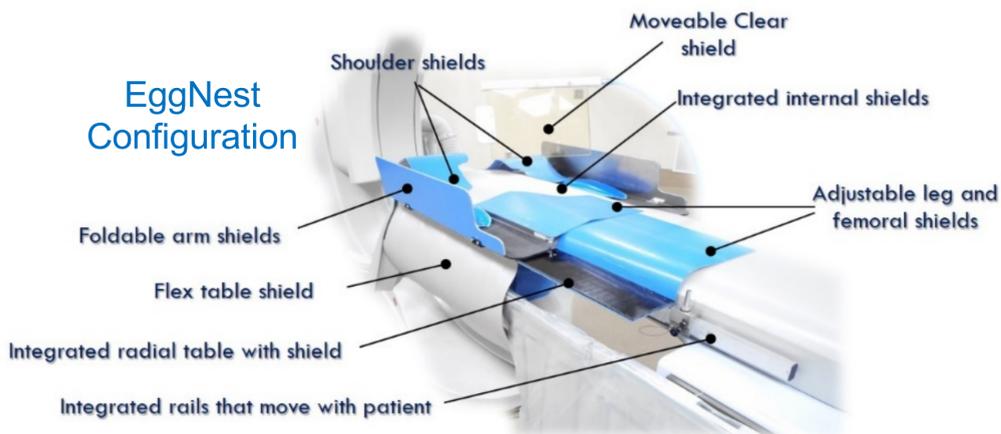


A New Device to Markedly Reduce Cardiac Cath Lab Radiation Levels

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Background

- Heart team exposure to scatter radiation is a serious health risk
- Spot shielding reduces operator exposure, but its effectiveness in reducing overall room scatter radiation (SR) levels, particularly during imaging with angulated x-ray views, is limited.
- We developed an integrated shielding system (the EggNest, Egg Medical, Maple Grove, MN), that passively moves with the x-ray gantry and the patient, to reduce Total Room Scatter Radiation



Study Objective

We evaluated the effectiveness of a new, passive protection system (the **EggNest**, Egg Medical, Maple Grove, MN) to reduce overall personnel exposure in x-ray projections commonly used for coronary and structural heart procedures.

Experimental Protocol

- Toshiba Infinix (2014) fixed C-arm x-ray system: 70 keV fluoroscopy at 15 fps
- US Department of Energy calibrated human phantom
- Scatter radiation measured with RaySafe X2 radiation meter (Fluke Biomedical)
- Measurements taken from 20 cm to 200 cm from the floor in each position

Protocol 1

- PA Projection
- Scatter radiation measured at 6 positions around the cath lab table corresponding to locations typically occupied by cath lab personnel
- Measurement obtained with three levels of radiation protection
 - No shielding
 - Standard shielding - hanging shield and table shield, both 0.5 Pb equivalent
 - The EggNest

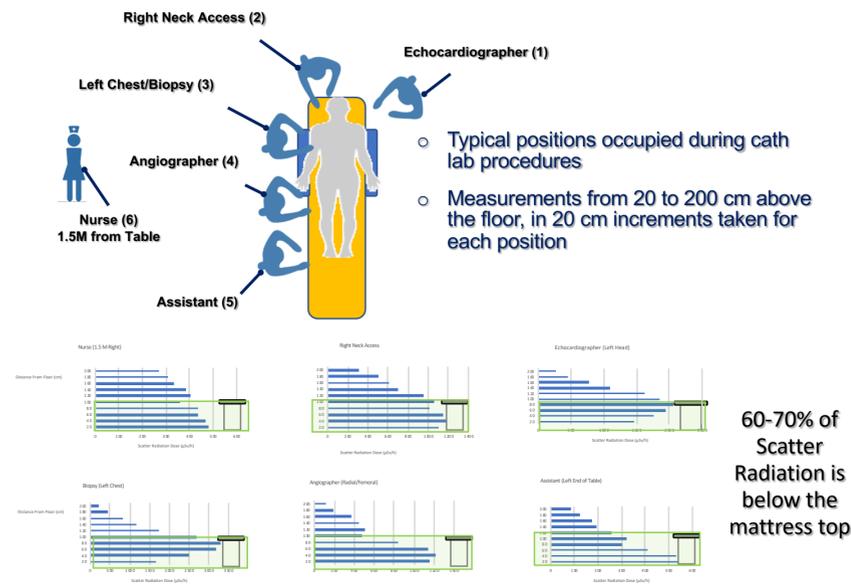
Protocol 2

- Repeat measurement in angulated views
 - RAO 30/20 Caud, RAO30/20 Cran, LAO40/30 Cran, LAO40/30 Caud

Data Analysis

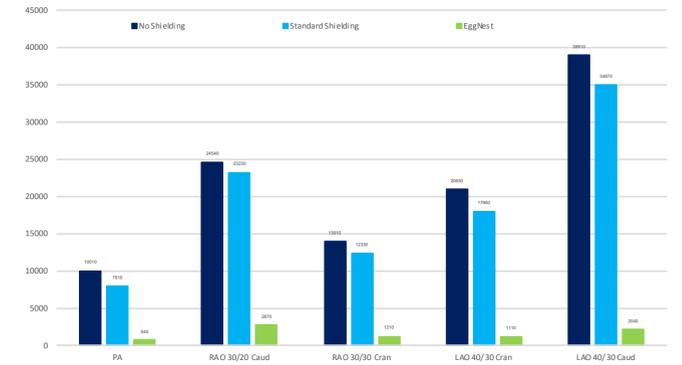
- Scatter radiation measurements are expressed in $\mu\text{Sv/h}$
- Total Room Scatter Radiation** was calculated as the sum of radiation measurements at all levels and positions around the cath lab table.

Distribution of Scatter Radiation Around the Cath Lab Table



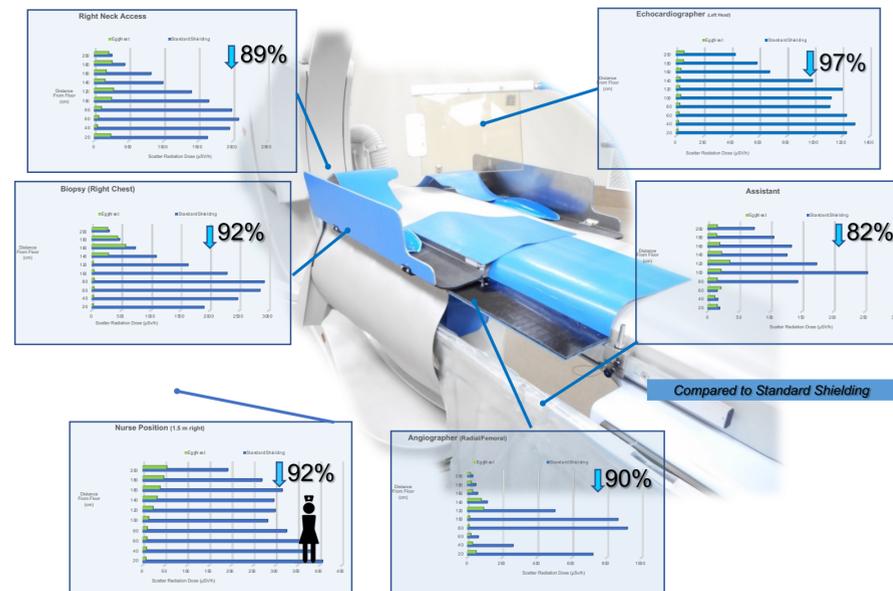
Total Room Scatter Radiation with Standard and Egg Nest Shielding

Total Room Scatter Radiation ($\mu\text{Sv/h}$)



Total Room SR ($\mu\text{Sv/h}$)	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

Effect of EggNest Shielding on Scatter Radiation Around the Cath Lab Table



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

Position	Reduction in SR with the EggNest Compared to Standard Shielding					Ave
	PA	RAO 30 Caud 20	RAO 30 Cran 20	LAO 40 Cran 30	LAO 40 Caud 30	
1. Echo	-97%	-87%	-91%	-94%	-90%	-92%
2. R Neck	-89%	-81%	-87%	-94%	-95%	-89%
3. L Chest	-92%	-94%	-93%	-97%	-95%	-94%
4. Operator	-90%	-98%	-90%	-73%	-94%	-89%
5. Assistant	-82%	-80%	-72%	-48%	-95%	-75%
6. Nurse	-92%	-91%	-93%	-95%	-98%	-94%
Total Room SR	-92%	-88%	-90%	-94%	-94%	-92%