A New Device to Markedly Reduce Personnel Radiation Exposure in the Cardiac Cath Lab

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• I, Robert F. Wilson, DO have a financial interest/arrangement or affiliation with one or more organizations that could be perceived as a real or apparent conflict of interest in the context of the subject of this presentation.

• I am a Founder and CEO of Egg Medical, Inc.
Carbon fiber sled platform

**Flex Shield Radiation Protection System**
- Conforms to the patient’s body to provide effective shielding
- Flexes to allow full X-ray gantry motion
- Radial, femoral and neck access protection

**Integrated ECG wiring**
Methods- Measurement of Scatter Radiation

Experimental set-up

- Toshiba Infinix (2014) fixed C-arm x-ray system: **70 keV fluoroscopy at 15 fps**
- US Department of Energy calibrated human anthropomorphic phantom
- Scatter radiation measured with RaySafe X2 radiation meter (Fluke Biomedical)

Protocol

Scatter radiation measured:
- At 6 positions around the cath lab
- In 5 angiographic views

Measurements taken from **20 cm to 200 cm from the floor** in each position

Measurement obtained with **three levels of radiation protection**
- No shielding
- Standard shielding consisting of a hanging shield and table shield, both 0.5 Pb equivalent
- The EggNest
Distribution of Scatter Radiation by Position Around Table and Height From Floor (PA projection)

70% of scatter radiation comes from below the table mat surface.

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**Biopsy (Right Chest)**

**Right Neck Access**

**Echocardiographer (Left Head)**

**Nurse (1.5 M Right)**

**Angiographer (Radial/Femoral)**

**Assistant (Left End of Table)**
Effect of EggNest on Scatter Radiation: Head and Nurse Positions

- **Right Neck Access**
  - EggNest: 93% compared to Standard Shielding
  - **Echocardiographer**
  - EggNest: 93% compared to Standard Shielding

- **Nurse Position (1.5 m Right)**
  - EggNest: 89% compared to Standard Shielding

*Compared to Standard Shielding*
Effect of EggNest on Scatter Radiation: Right Table Operator Positions

**Biopsy (Right Chest)**

- EggNest: 94%
- Standard Shielding

**Assistant (Radial/Femoral)**

- EggNest: 93%
- Standard Shielding

**Aniographer (Radial/Femoral)**

- EggNest: 90%
- Standard Shielding

Comparing EggNest to Standard Shielding:

- Biopsy: 94%
- Assistant: 93%
- Aniographer: 90%
Average Scatter Radiation In Angulated X-ray Views is Markedly Attenuated By the EggNest

*Average scatter radiation dose for all heights and positions for each angulation*
**EggNest Reduction in Scatter Radiation Compared to Standard Shielding**

<table>
<thead>
<tr>
<th>Position Around Table</th>
<th>PA</th>
<th>RAO 30 Caudal 20</th>
<th>RAO 30 Cranial 20</th>
<th>LAO 40 Cranial 30</th>
<th>LAO 40 Caudal 30</th>
</tr>
</thead>
<tbody>
<tr>
<td>Echocardiographer</td>
<td>93%</td>
<td>95%</td>
<td>91%</td>
<td>96%</td>
<td>41%</td>
</tr>
<tr>
<td>Right Neck</td>
<td>93%</td>
<td>71%</td>
<td>94%</td>
<td>90%</td>
<td>81%</td>
</tr>
<tr>
<td>Biopsy</td>
<td>94%</td>
<td>95%</td>
<td>92%</td>
<td>88%</td>
<td>74%</td>
</tr>
<tr>
<td>Angiographer</td>
<td>90%</td>
<td>43%</td>
<td>80%</td>
<td>86%</td>
<td>5%</td>
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<tr>
<td>Assistant</td>
<td>93%</td>
<td>92%</td>
<td>87%</td>
<td>84%</td>
<td>17%</td>
</tr>
<tr>
<td>Nurse</td>
<td>89%</td>
<td>91%</td>
<td>88%</td>
<td>91%</td>
<td>53%</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td>93%</td>
<td><strong>88%</strong></td>
<td><strong>91%</strong></td>
<td><strong>90%</strong></td>
<td><strong>62%</strong></td>
</tr>
</tbody>
</table>

*Average scatter radiation dose for all heights for each angulation*
Conclusions

- The majority of x-ray scatter radiation in any angiographic projection comes from below the mattress top.
- Standard shielding provides modest protection for the angiographer positioned at the radial/femoral access sites, but no protection for the remainder of the staff or for procedures with head access.
- Angulated views significantly increase staff radiation exposure and standard shielding provides limited protection from scatter radiation.
- The EggNest provides significantly more complete protection for both the physician and the staff in the room without comprising imaging flow.
  - Better protection in all positions around the table.
  - Better protection in all angiographic views tested.