# Your Head Is Getting More Radiation Than You Think: The Vertical Exposure Gap and Scatter Radiation in the Cath Lab

*81% head Dose reduction observed with Steradian Shield compared to no "sterile radiation absorbing pad" and 71% reduction when compared standard horizontal radiation absorbing pad: Live dosimetry measurements across 11 patients and 106 readings raises serious concerns regarding current lack of protection from the* ***Vertical Gap Exposure.***

**Carmelo J. Panetta, MD**

*Interventional Cardiologist · M Health Fairview MN* · St. Paul, MN · Practice Since 2002

## Background and the Vertical Gap Problem

After more than 20 years of performing interventional cardiology, I followed standard radiation protection protocols—including lead aprons, table skirts, ceiling shields, and horizontal scatter radiation pads—assuming they were sufficient. They were not.

Scatter radiation is most intense where the x-ray beam enters the patient, dispersing as secondary energy. A significant vulnerability exists in the vertical exposure "gap" created between the patient's upper torso and the bottom edge of the fixed ceiling shield, or between the patient and the image intensifier when ceiling shielding is not deployed. These gaps shift and open continuously with table movement, camera angulation, and varying body shapes, making it nearly impossible to eliminate them with a fixed shield alone.

Addressing this is critical, as existing literature has raised serious concerns regarding cranial radiation and its association with cancer, cataracts, and cognitive effects (3, 4). Furthermore, horizontal radiation pads have been found to provide only modest upper-body protection (2).

While a 2020 clinical study demonstrated a 40% reduction in operator exposure using the "LockBlock" vertical device, horizontal attenuation pads were still unable to cover the vertical gap. For this paper, live dosimetry was measured across 11 patients at eight U.S. hospital catheterization laboratories. The data confirms that blocking the vertical gap with the Steradian Shield™ (Radux Devices) reduced operator head exposure by an average of 81% compared to using ceiling shielding alone. Additionally, the Steradian Shield™ demonstrated a 71% improvement in protection over standard horizontal radiation pads.

### Methods:

Data was collected during evaluations at 8 U.S. catheterization laboratories. A total of 53 paired measurements were recorded across 11 patients at multiple institutions. This is observational data from catheterization laboratory cases at the request of the operator to record their radiation exposure. 9 cases compared Steradian Shield™ to no horizontal radiation pad, 1 patient compared Steradian

Shield™ to either horizontal radiation pad or no horizontal radiation pad and 1 patient compared to horizontal radiation pad.

Measurements were obtained using a RaySafe™ 452 radiation dosimeter (RaySafe™, Sweden) positioned at the operator's left head and neck level. Data was captured during active fluoroscopic cases in the LAO projection, comparing the Steradian Shield™ against either no shielding or a standard horizontal radiation pad. For these trials, the Steradian Shield™ was deployed in the "two-plane" position to provide both vertical and horizontal coverage (see Figure 1).

Each paired measurement consisted of one reading with the Steradian Shield™ and one with either no shielding or a horizontal pad, while all other procedural conditions were held constant. To prioritize radiation data, no patient or procedural specifics were recorded; only the exposure levels captured by the RaySafe™ 452 were analyzed.

Because measurements can vary based on patient size, X-ray equipment, LAO angle, and fluoroscopy time, multiple recordings were taken for each patient. The difference in radiation exposure between the Steradian Shield™ and the control (no shielding or horizontal pad) was calculated per patient, and these results were then averaged across the group. Finally, p-values were calculated for each individual patient using a two-tailed t-test for two samples of unequal variances.

**Figure 1**: Placement of Steradian Shield™ in "two plane" position with the ceiling shield in place.*The Steradian Shield™ addressing both the vertical exposure gap (upper component) and horizontal exposure gap (lower component) during a catheterization procedure.*

## Results:

### Steradian Shield™ vs either no shielding or horizontal radiation pad

The Steradian Shield™ reduced operator head dose by an average of 81.6% amongst 11 cases/patients in the LAO projection when combined either comparison of Steradian Shield™ to no radiation pad or Steradian Shield™ to horizontal radiation pad.

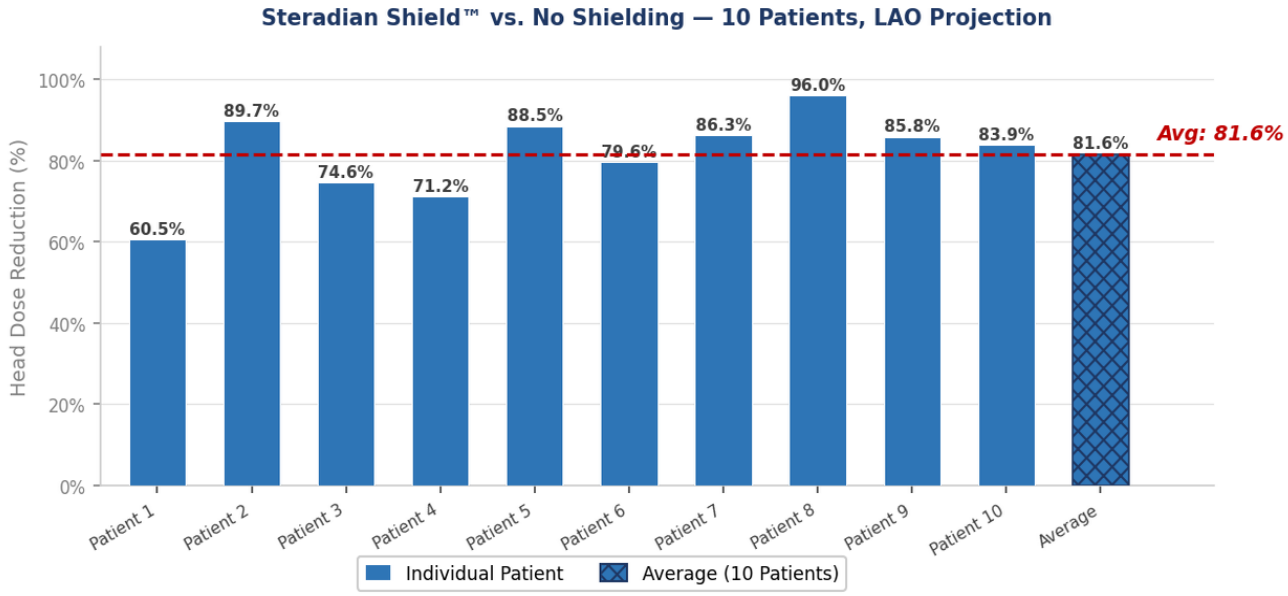
**Figure 2:** Combination of 11 cases comparing Steradian Shield™ to either horizontal radiation pad or no horizontal radiation pad.

| 11 | 53 | 81.6% | p < 0.05 |
|---|---|---|---|
| **Patients Evaluated** *Multiple U.S. Cath Lab Centers* | **Paired Measurements** *Steradian vs. No Shielding* | **Avg Head Dose Reduction** *Range: 60% – 96%* | **Statistical Significance** *All Patient Subgroups* |

### Steradian Shield™ vs. No Shielding — 10 Patients, LAO Projection

The Steradian Shield™ reduced operator head dose by an average of **81%**, with individual patient reductions ranging from **60% to 96%** ($p < 0.05$ across all patient subgroups).

***Table 1***. *Per-patient head dose reduction (%) with Steradian Shield™ vs. no shielding across 10 patients with 81.4% (range 60%–96%). $p < 0.05$.*




### Steradian Shield™ vs. Horizontal Radiation Pads — 2 Patients, LAO Projection

In a direct head-to-head comparison against a horizontal radiation pad, the Steradian Shield™ reduced operator head dose by an average of **71.7%** (n=2 patients), with reductions of **63% and 80% (p<0.05)**. This comparison is particularly meaningful: horizontal radiation pads represent the most common supplemental protection currently in use across U.S. catheterization laboratories. Even against this comparator, the addition of vertical exposure gap coverage with the Steradian Shield™ produced a substantial and statistically significant reduction in head dose.

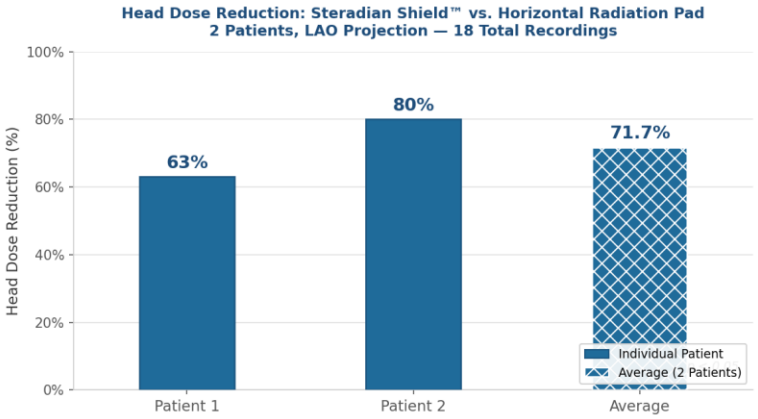



***Table 2**. Per-patient head dose reduction (%) with Steradian Shield™ vs. horizontal radiation pad across 2 patients. Average reduction 71.7% (range 63%–80%). $p < 0.05$. Total of 18 recordings.*

## What This Means

This study demonstrates a dramatic reduction in scatter radiation exposure to the operator's left head and neck when the vertical exposure "gap" is addressed using the Steradian Shield™. Across 11 different patients, physicians, and hospital settings, the data confirmed that the Steradian Shield™ blocked 81% of radiation exposure to the left head. Furthermore, when compared directly to a horizontal radiation pad in two separate procedures, the device yielded an additional 71% reduction in exposure.

These provocative findings suggest that while horizontal radiation pads offer nominal benefits, the vast majority of head radiation stems specifically from the vertical exposure "gap." For physicians and cath lab managers concerned about cumulative lifetime radiation exposure, this gap represents a significant and previously under-addressed contributor to dose.

Historically, protecting the operator's head and neck has been difficult, largely due to a lack of practical tools to identify or mitigate this specific vulnerability. That has changed. The vertical exposure gap is no longer an abstract concept; it is measurable, consequential, and now has a clinical, disposable solution in the Steradian Shield™.

> After more than 20 years in the interventional laboratory, I am convinced that closing the **vertical exposure gap** is the single most important step an operator can take to protect the one part of their body that lead cannot cover — **the head.**

*Observational data collected during hospital evaluations at multiple U.S. catheterization laboratory centers using RaySafe dosimetry instrumentation. Statistical analysis performed using two-sample t-tests assuming unequal variance. Not intended as a formal peer-reviewed publication.*

Ref:

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