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Mitigating Radiation Risks in Interventional Cardiology: Dosimetric Analysis and Shielding Efficacy

Maria Anthi Kouri[1 3],Theano Marina Axakali[2], Evangelia Kounadi[3], Ioannis Tsiafoutis [4], Ioannis Karalis [4], Maria Agelaki [4], Apostolos Christou [4], Savvas Nikolidakis [4], Christos Michail[2],George Fountos[2]

[1]2nd Department of Radiology, Medical Physics Unit, Medical School, National and Kapodistrian University of Athens, 1 Rimini str., Chaidari, 12462, Athens, Greece

[2]Department of Biomedical Engineering,Radiation Physics, Materials Technology and Biomedical Imaging Laboratory, AKTYBA, University of West Attica, Egaleo, 12210 Athens, Greece

[3]Medical Physics, General Hospital GHA KorgialeneioMpenakeio-Hellenic Red Cross, Athens, Greece

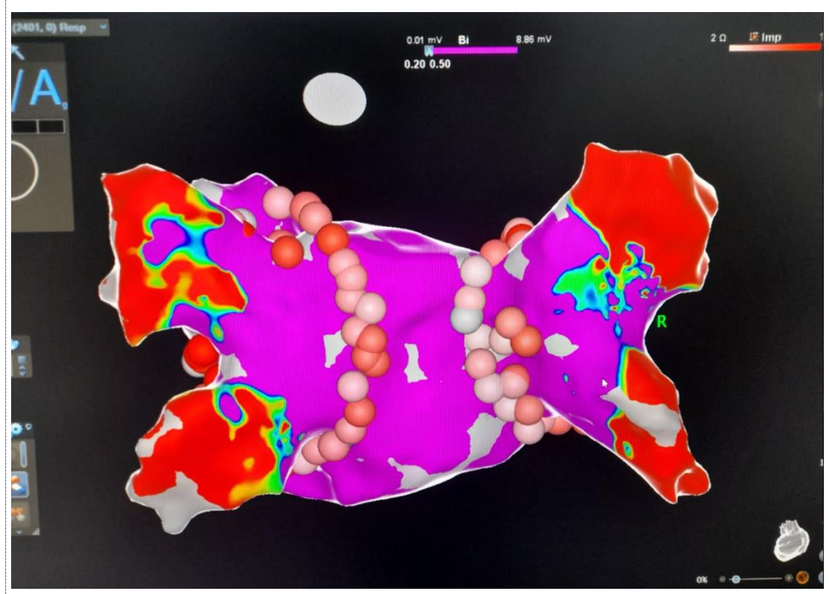
[4]Hemodynamic Laboratoty, General Hospital GHA KorgialeneioMpenakeio-Hellenic Red Cross, Athens, Greece

1. Background-Aim

Interventional cardiology heavily relies on ionizing radiation for vital procedures such as Ablations and the Implementation of Pacemakers.

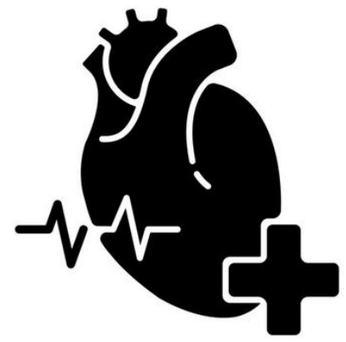
Health risks to interventional cardiologists→ elevated levels of secondary radiation and the effects of ionizing exposure.

Radiation protection measures, such as radiation shielding is important, when reducing the time of exposure is not feasible.



CARTO 3 System, Cardiac Mapping for Ablation.

Dosimetric assessments are crucial to evaluate and manage radiation risks ensuring the safety in interventional cardiology.



1. Background-Aim

This study conducted a dosimetric assessment to evaluate variations in radiation exposure

- Per interventional procedure
- Among operating cardiologists

Data from **real-time dosimeters** were collected pre and post the implementation of an appropriate radioprotective shield, **Egg Nest**, designed to reduce ionizing radiation exposure for interventional cardiologists without affecting clinical practice.

Real Time Dosimeters

Real Time Dosimeters

Electronic dosimeters for personnel with real-time monitoring of X and gamma radiation Hp(10) per minute, featuring dose and dose rate warnings, as well as software accessible via cloud without installation on a computer.

2. Materials & Methods

Radiation protection is of paramount importance in interventional laboratories, as cardiologists remain within the room during radiation exposure.

- Previous studies (Wilson et al [3], Steege et al [4]) demonstrated reduced radiation dose of 82% to 97% with the aid of the Radioprotective shield, **Egg Nest**.

The Egg Nest radiation protection shield:

→Adapts to all types of fluoroscopic systems.

→Interacts only with scattered and leakage radiation from the X-ray tube.

→Provides protection to all individuals present in the room.

The systems from which the measurements were obtained:

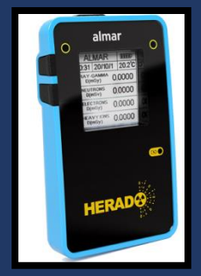
- *Philips Azurion 3 M12 C-arm*
  - →X-ray tube (40-125 kVp,) flat panel detector, field sizes of 30, 27, 22, and 19 cm.
  - →Automatic exposure control system and anti-scatter grid (Bucky).

- *Siemens Artis Zee*
  - → Flat panel detector 20x20, field sizes of 25, 20, 16, and 8 cm.
  - →Automatic exposure control system and anti-scatter grid (Bucky).

Implementation of the radioprotective shielding/Egg Nest

2. Materials & Methods

Dose measurements were performed with **active personal dosimeters** with simplified dose readings directing on the screen, via PC.



Automatic transmission of radiation data of the active personal dosimeters **measure dose every minute.**

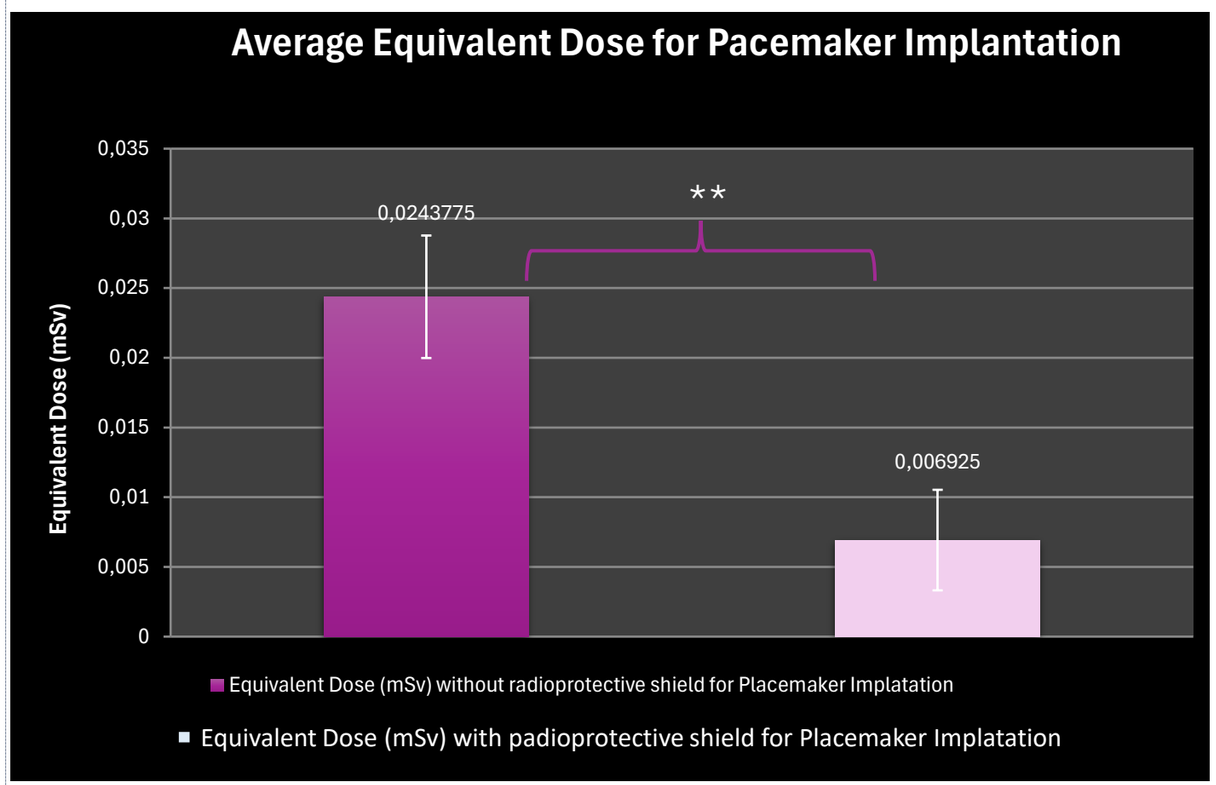
The dosimetric data is categorized for **each cardiological examination** and for **each individual cardiologist.**

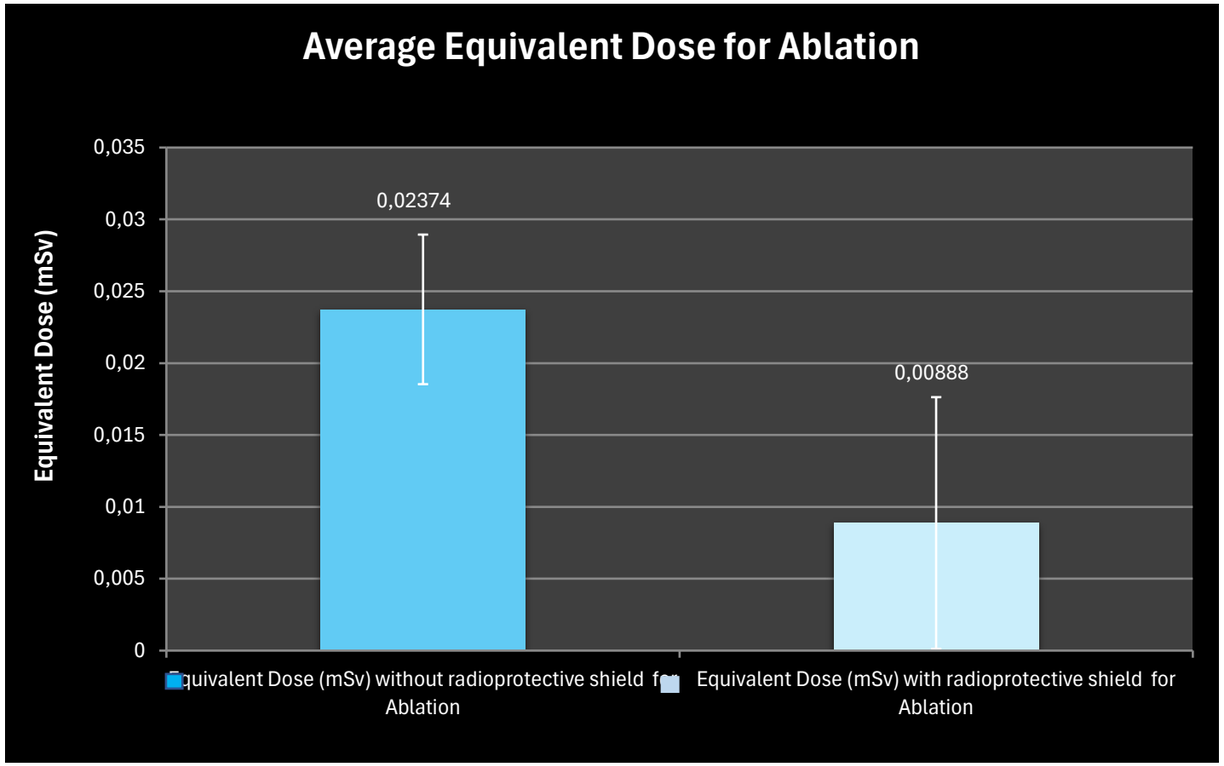
The same procedure was followed for the collection of dosimetric data **before and after the implementation of the protective shielding.**

Statistical analysis was conducted to verify the statistical significance of the results.

3. Results

REAL TIME DOSIMETERS: DOSIMETRIC DATA PER CARDIOLOGIST AND PER PROCEDURE BEFORE AND AFTER THE IMPLEMENTATION OF THE RADIOPROTECTIVE SHIELDING





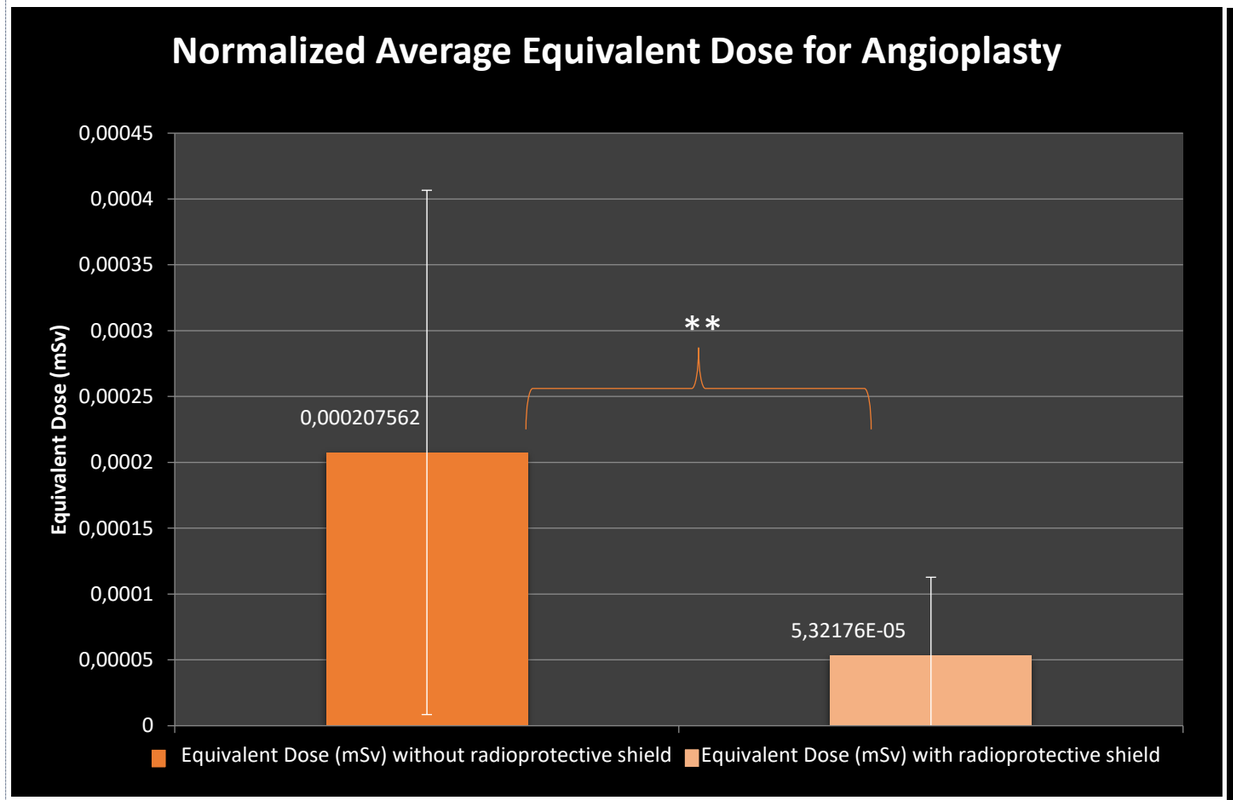
* < 0.05
** < 0.005

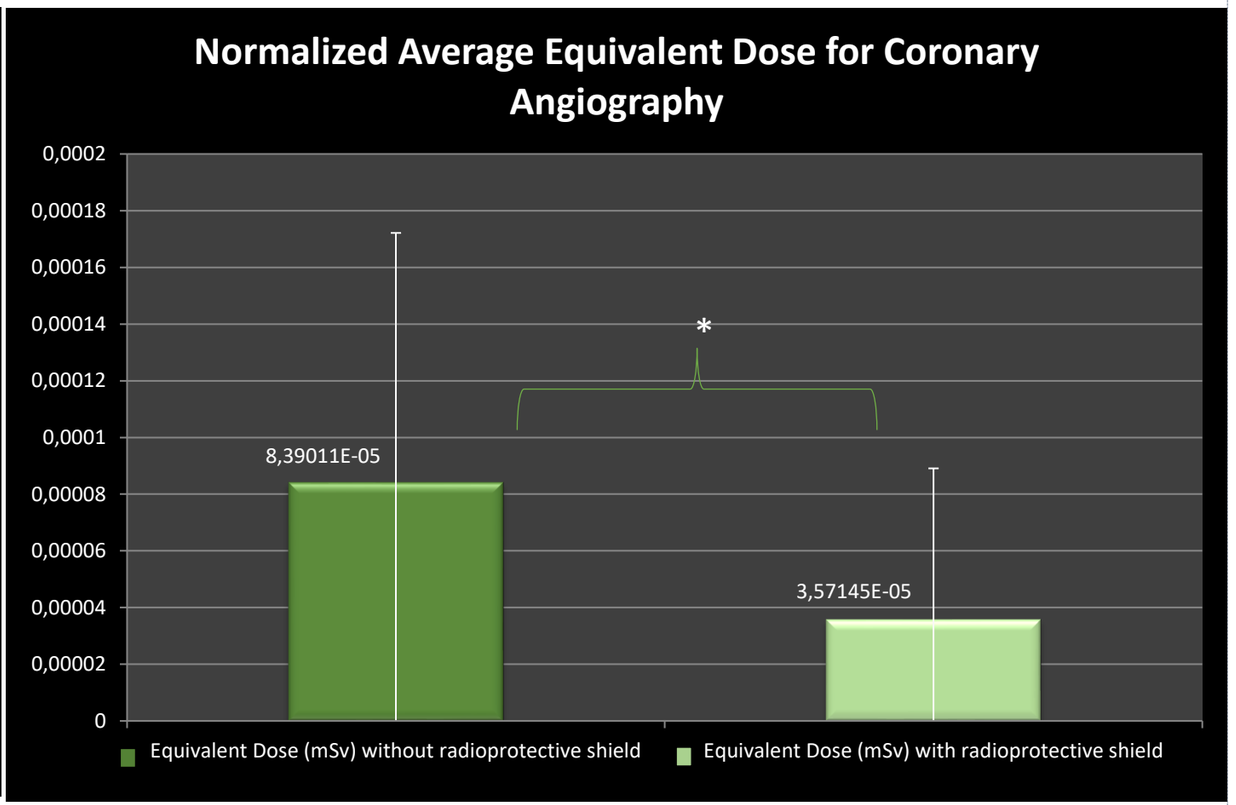
There is a reduction in the dose when the protective shield, Egg Nest, is used, reaching up to **71.59%** for Pacemaker Implantation and up to **62.59%** its initial value for Ablation.

The measurements for the Pacemaker Implantation, indicate that there is a statistically significant difference in the reduction of the dose.

3. Results

REAL TIME DOSIMETERS: DOSIMETRIC DATA PER CARDIOLOGIST AND PER PROCEDURE BEFORE AND AFTER THE IMPLEMENTATION OF THE RADIOPROTECTIVE SHIELDING





* < 0.05
** < 0.005

There is a reduction in the dose when the protective shield, Egg Nest, is used, reaching up to **74.36%** for Angioplasty and up to **57.43%** its initial value for Coronary Angiography.

The measurements of doth Procedures , indicate that there is a statistically significant difference in the reduction of the dose.

4. Conclusions

Reducing radiation exposure further is crucial for minimizing the risk of future stochastic effects among interventional cardiologists.

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The results emphasize the necessity for ongoing optimization of radiation protection measures and dosimetry techniques to ensure the safety of healthcare professionals exposed to ionizing radiation.

- The carbon fiber base platform and the modular shielding components make the **Egg Nest** suitable for C-arm systems, as they do not obstruct the movement of the arm.
- This ensures optimal imaging and positioning of the C-arm while simultaneously allowing an uninterrupted overall process, including patient placement.

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Egg Nest shield leads to a dose reduction of **up to 71.59%** upon the specific procedures employed by each cardiologist.

5. References

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