Radiation Protection Training And Coaching In A Simulated Hybrid Suite Markedly Reduces Radiation Exposure To Patients And Staff

Lars Lönn MD PhD Professor
Copenhagen University and National Hospital Denmark
On behalf of the team members of The Endovascular Team
Centre for Clinical Education Copenhagen

Disclosure
Lars Lönn
-a part-time clinical advisor for Mentice

The need for radiation protection became evident, and the ICRP was established in 1928

International Commission on Radiological Protection

Lack in Operator Understanding of Radiation

61% 22% 81% 20%

61% of radiologists underestimated the dose for one CT scan compared to one chest x-ray by over 10 times
22% of interventional radiologists do not wear dosimeter
81% of the interventional cardiology fellows did not know their radiation exposure
20% of internists believe MRI is ionizing


Dose Per Procedure

Minimize dose
Image management focus on the main task

Daily life includes radiation exposure
Cataracts in Interventional Cardiologists

Most lens injuries after years of work without eye protection

So... What can we do?

Pretty much everything!

Training has been proven to work

Societies and regulators address the problem

- Circulation, Nov. 2014: Approaches to Enhancing Radiation Safety in Cardiovascular Imaging: A Scientific Statement From the American Heart Association
- Eur. Heart J., Mar 2014: The appropriate and justified use of medical radiation in cardiovascular imaging: a position document of the ESC Associations of Cardiovascular Imaging, Percutaneous Cardiovascular Interventions and Electrophysiology
“Education, justification, and optimization are the cornerstones to enhancing the radiation safety of medical imaging.”

Functionality for simulated radiation training

- Evidence-based radiation model with focus on ALARA training
  - Real-time, based on research models and modern x-ray systems
  - Calculates air kerma and KAP rates
  - Dose rate correspondingly affects fluoroscopy noise

- Common operator controlled functions from all major vendors
  - Collimation
  - Wedge filters
  - Dose level
  - Fluoro store
  - Virtual collimation/filters/panning

- Live visualizations of patient and operator exposures

Improving Teamwork through Training & Education

Integrated with work
- On the Job
- In Situ
- Sim Center

Classroom
Separate from work

CTA segmentation and 3D model generation
STL Stitching

The Result – Radiation Model

Dose model calculates PSD, KAP and air kerma.

Visual indicators display current dose situation.

Audible and visual dose threshold warnings.

Variable focus area rendering specific to tasks, patient size, frame settings, etc.

The Result – Live Dose Visualizations

Show dose rates & control risks.

Effects of wearing protective gear.

Surgeon, x-ray tech & staff doses.

Patient dose, fix & type of imaging adverse effects.

Heatmaps of scatter dose field around patient.

Heatmaps of patient skin dose distribution.

DOSE HEAT MAPS

Patient heat map

Staff heat map

Display x-ray beam geometry.

Show location of PSD on patient.

Show staff positions in radiation field.

Heatmaps of scatter dose field around patient.
Cardiology Dep

Endovascular Dep

https://rupp.ieee.org