Real-time Dosimetry
Toy or Tool?

Alexander Gangl, MSc.
Department of Radiology
University Hospital Graz
Disclosure

Speaker name:
Alexander Gangl MSc.

I have the following potential conflicts of interest to report:

- [ ] Consulting
- [ ] Employment in industry
- [ ] Stockholder of a healthcare company
- [ ] Owner of a healthcare company
- [ ] Other(s)

- [x] do not have any potential conflict of interest
New insights – changed Thresholds

Tissue Weighting Factors for Calculating Effective Dose

Development of $W_T$-values (breast, gonads)
New insights – changed Thresholds

Fetal dose limit

- **1977 – ICRP Publication 60**
  Dose equivalent limit for the embryo/fetus of a declared pregnant occupational worker must not exceed **5 mSv**

- **2007 - ICRP Publication 103**
  Dose limit was reduced from **5 mSv** to **1 mSv**
New insights – changed Thresholds

Dose exposure to the lens of eye:

Lens of the eye seems to be more radiosensitive than previously thought…

• 2011: ICRP Recommendation for occupational exposure

• 2014: IAEA (General Safety Requirements Part 3)

Equivalent dose limit for the lens of the eye for occupational exposure: 150 mSv/a to 20 mSv/a

BUT THERE IS NO CLEAR STATEMENT WHETHER RADIATION INDUCED CATARACT IS A DETERMINISTIC OR A STOCHASTIC EFFECT !!!
Cataract - Dosimetry

International Atomic Energy Agency (IAEA)

WORKERS FOR WHOM EXPOSURE OF THE LENS OF THE EYE MIGHT BE IMPORTANT:

“Staff working in close proximity to patients in fluoroscopy guided interventional procedures”

“Thermoluminscent Detectors (TLD) beneath the lead apron causes underestimation of adsorbed dose of unshielded areas (e.g. eyes)”

(ECR2014 Scientific Exhibit Y. Y. Yanet et al.)
Cataract - Dosimetry

International Commission on Radiation Protection (ICRP)

• Dosimeter worn above lead apron:
  Overestimation of effective dose

• Dosimeter worn under lead apron:
  Underestimation of effective dose

Recommendation: DOUBLE DOSIMETRY
Double Dosimetry

...to estimate the dose to the lens of eye

Beyond the lead apron: TLD

Over the lead apron: personnel dose meters
Real-time Dosimetry

TECHNICAL DEMANDS

• High Measuring Accuracy
• Uniform Measuring Values
• Equal to other Dosimetry Systems
• Good Angular Response
• Large Spectrum of Photon Energies
Real-time Dosimetry

TECHNICAL DEMANDS

Uniform Measuring Values; Energy Dependence

PDM_GREY, PDM_BLUE and PDM_RED in comparison

Dose Quantities \{Q1, Q2, Q3\} paired with altering distances \{A1, A2, A3\}
Real-time Dosimetry

TECHNICAL DEMANDS – Angular Response
Real-time Dosimetry

TECHNICAL DEMANDS – Comparability: PDM vs. TLD

Ratio Thyroid / Nasal root

PDM: 1.67 – TLD: 1.595

Ratio Sternum/ Nasal root

PDM: 1.94 – TLD: 1.95
Real-time Dosimetry

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EDUCATIONAL VALUE

Real-time dosimetry visualizes individual information regarding current dose exposure. Studies have shown, that real-time dosimetry is a useful tool to for medical staff self-training by improving the behavior in range of radiation.

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