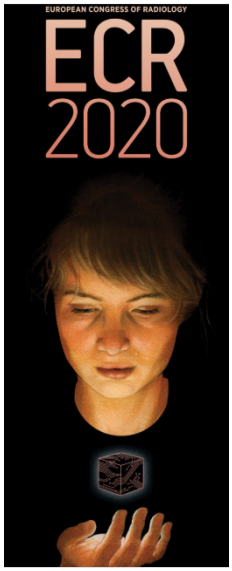

October 2020 (on line)

DICOM image and radiation dose structured report (RDSR) dose parameters: what do we have, what do we need?

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Learning objectives

- 1. To appreciate the relevance of the **dosimetric information available during and at the end** of interventional procedures to help in optimisation.
- 2. To learn that **additional details on technical parameters are available in the DICOM RDSR**, helping to audit individual procedures.
- 3. To understand how the **information contained in the RDSR for radiation events** may be helpful in optimising some individual procedures.

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COUNCIL DIRECTIVE 2013/59/EURATOM

of 5 December 2013

laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom

Article 5

Optimisation requires the knowledge of individual patient doses

The optimisation of the protection of individuals subject to medical exposure shall apply to the magnitude of individual doses and be consistent with the medical purpose of the exposure, as described in Article 56.

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Required by the European Directive 2013/59/EURATOM (art. 60)

1) **Dosimetric information at the end of the procedures.**
   - Any equipment used for **interventional radiology and computed tomography** … has a device or a feature informing the practitioner, at the end of the procedure, of relevant parameters for assessing the patient dose.
2) **Dosimetric information during the procedures.**
   - Any equipment **used for interventional radiology** has a device or a feature informing the practitioner and those carrying out practical aspects of the medical procedures of quantity of radiation produced by the equipment **during the procedure.**

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Optimisation for Computed Tomography and for Interventional Radiology

1) **Optimisation in planning the procedures, during the procedures and after the procedures (for future procedures).**
2) **Dosimetric information at the end of the procedures.**
   - CT: Dose Length Product and $CTDI_{vol}$
   - **Int. Radiol: KAP, CAK, Peak Skin Dose (PSD)**
3) **Dosimetric information during the procedures.**
   - **KAP, CAK rates and in some cases PSD or skin dose maps.**
4) **After the procedure.**
   - **If available organ and effective dose estimations for consideration in future procedures.**
   - **Skin dose maps for future procedures**

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Dosimetric data for optimisation (IR)

Validation of dosimetric quantities and updating calibration factors

1) **Collecting data** from the DICOM Radiation Dose Structure Reports (RDSR)
   - Managing **global dosimetric data** per procedures (KAP and CAK).
   - Also analysing **individual radiation events** (fluoroscopy, cine, DSA and CBCT runs).
2) **Comparison of median values** of global dosimetric data (from the last 20-30 procedures) with DRLs.
3) **Setting levels for individual high dose values** to consider possible clinical follow-up for skin injuries.

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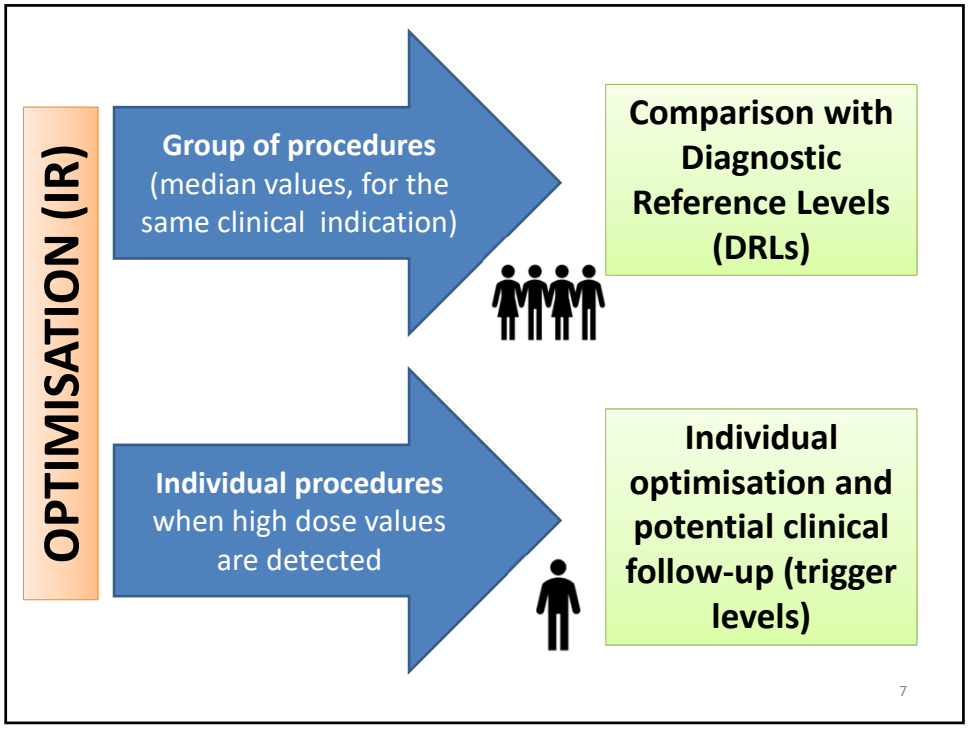
OPTIMISATION (IR)
Group of procedures
(median values, for the same clinical indication)
Comparison with Diagnostic Reference Levels (DRLs)
Individual procedures
when high dose values are detected
Individual optimisation and potential clinical follow-up (trigger levels)
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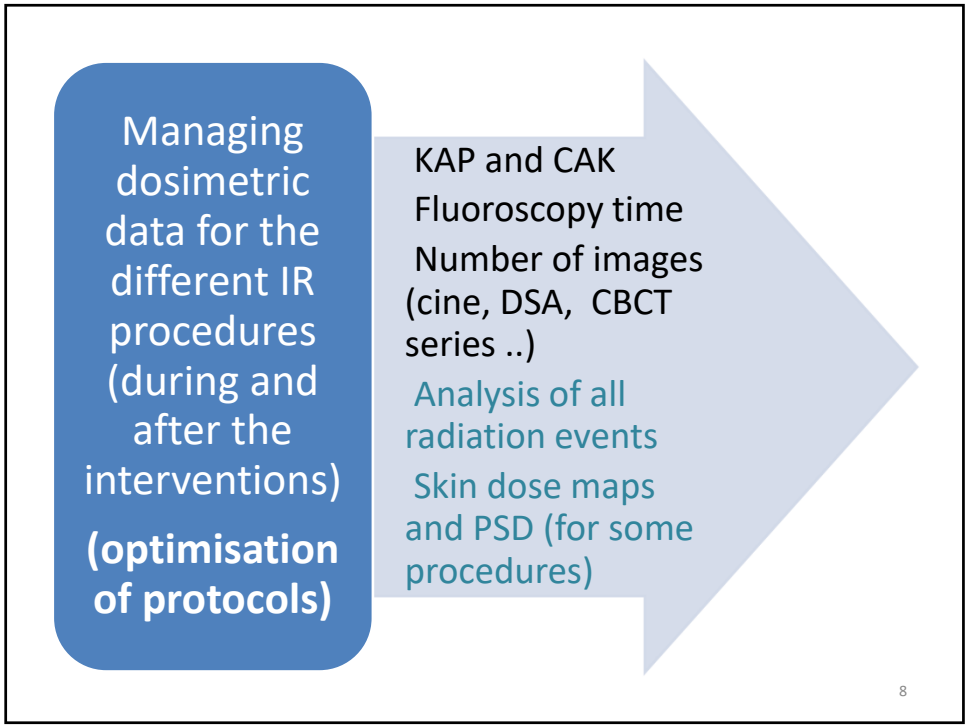
Managing dosimetric data for the different IR procedures (during and after the interventions)
(optimisation of protocols)
KAP and CAK
Fluoroscopy time
Number of images (cine, DSA, CBCT series ..)
Analysis of all radiation events
Skin dose maps and PSD (for some procedures)
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San Carlos University Hospital (Madrid)
(Ref. DOLQA new 8July2020)

Sample of 3874 **CT procedures**
with 7381 events:
Events/procedure = 1.91

Sample of 1060 **interventional procedures**
with 61629 events:
Events/procedure = 58

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Using radiation events data for optimisation

1) Individual Values of KAP and CAK (and number of frames and fluoroscopy time).
2) KAP/frame and AK/frame.
3) Collimation use (%).
4) Mean kV and added filtration.
5) Pulses/s and pulse width.
6) Percentage of fluoroscopy.
7) Dose contribution of CBCT, rotational and road maps.

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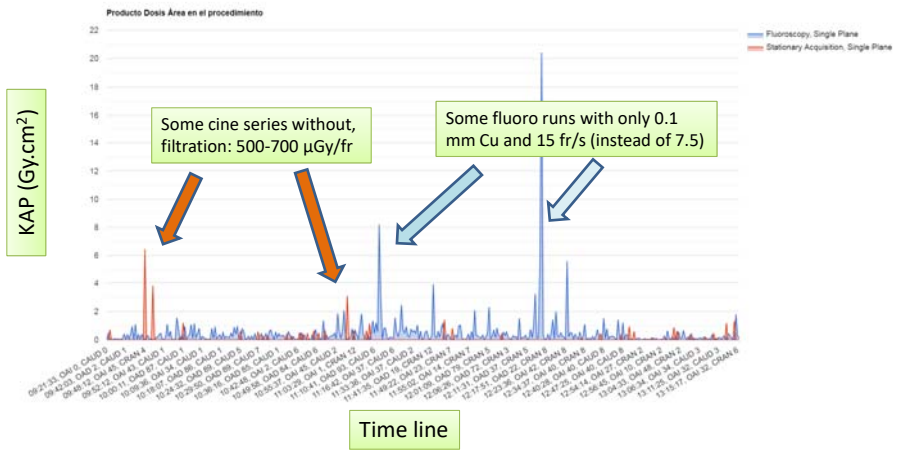
Example ¿what are the most irradiating series and projections?

Complex PTCA; KAP 209 Gy.cm^2; CAK 3485 mGy; C-arm scatter dose 2.52 mSv; 12.1 µSv/(Gy.cm^2); **84% fluoro** (0.1-0.4 mm Cu) and **16% cine** (0-0.4 mm Cu); collim. 60%



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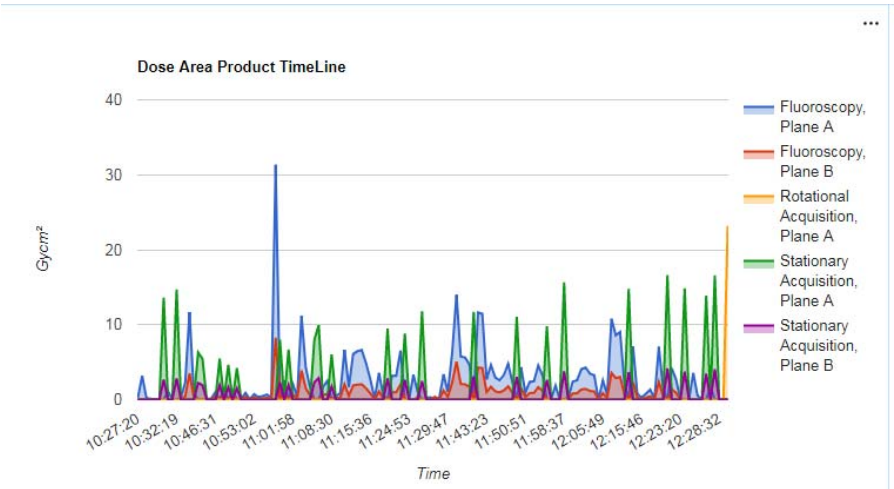
Example: Especial complexity for biplane systems and CBCT imaging acquisitions



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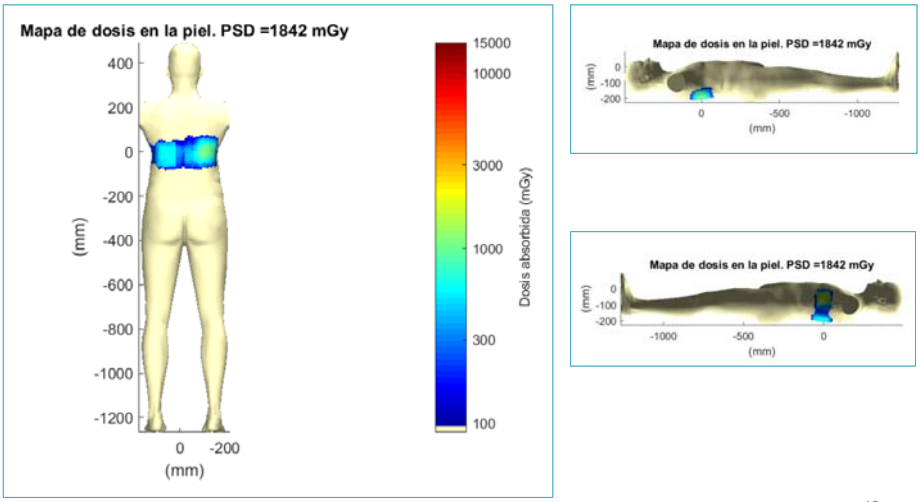
Skin dose map. Example using the radiation events

Complex PTCA; **KAP 209 Gy.cm^2; CAK 3485 mGy; Peak skin dose 1842 mGy**



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Audit for optimisation

- Continuous comparison of median values with DRLs
- **Audit process**
- Individual values for potential clinical follow-up in some cases (skin injuries)
- Optimise protocols managing all the individual radiation events and global data of the procedures

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Patient dose registry and optimisation. What do we have and what do we need

- **Better identification of the procedures** to classify dosimetric data and to compare with DRLs.
- **Identify repeated procedures on the same patient** and availability of previous dosimetric data (including skin dose maps). Some procedures have been done in other hospitals.
- Sometimes, **lack of information in the RDSR**.

- **Complexity of the procedures** (specially relevant in interventional radiology).

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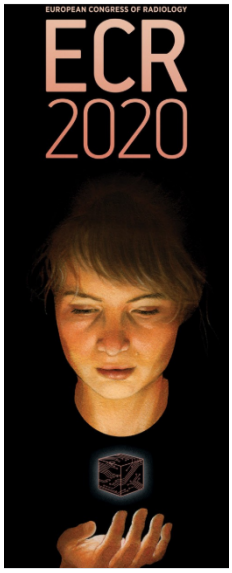

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Thank You

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