Managing occupational and patient doses for an integrated optimisation in interventional radiology

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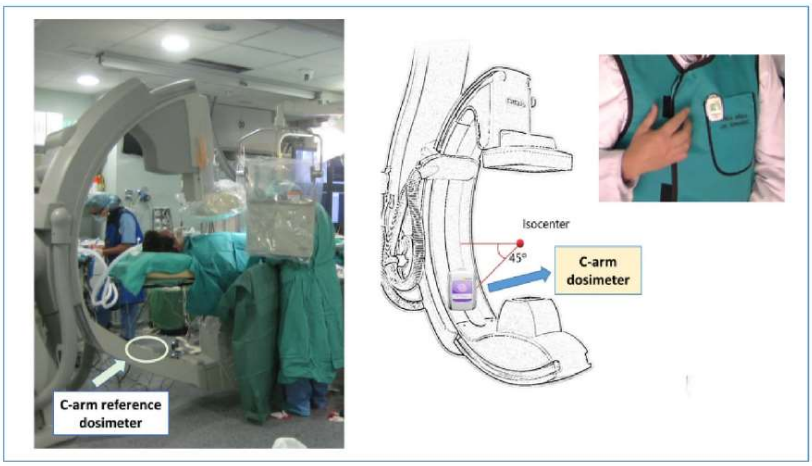
Introduction:

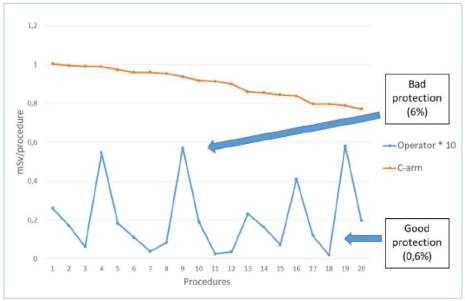
The International Commission on Radiological Protection recommends to manage occupational doses together with patient doses for an integrated approach in optimisation for interventional radiology. In most of the cases, occupational doses are not measured for individual procedures but for monthly periods and the level of radiation protection may be different for some specific clinical procedures.

Optimisation of occupational protection also requires to identify the potential problems with the proper and regular use of personal dosimetry. Optimisation may be easier with electronic personal dosimeters, including the use of ambient dosimeters at the C-arm of the interventional X-ray systems. Sometimes audit of occupational doses and a comparison with the values of the ambient dosimeter allows to identify the lack of occupational protection (e.g. the proper use of the ceiling suspended screen).

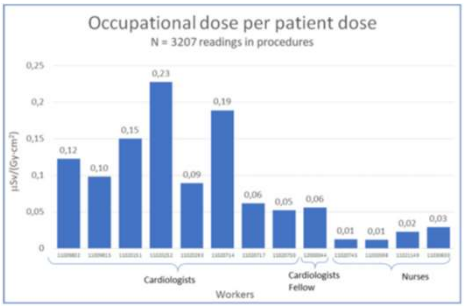
Materials and methods:

A homemade Dose Management System (DMS) called DOLQA (Dose On Line and Quality Assurance) used in the last two years in our university hospital, allowed to manage patient and occupational doses together for interventional procedures. Results are presented for three cardiac laboratories, two general interventional radiology rooms and one neuroradiology room. The initial approach to identify the optimisation priorities, has been, firstly, to audit the highest patient dose values and to look for the occupational dose values for these procedures and secondly, audit the highest occupational dose values (measured over the protective apron) and to identify the clinical procedures to detect potential lack of protection during some of the procedures. The selected parameters to investigate potential corrective actions have been: occupational doses per procedure higher than 0.5 mSv, or more than 3 mSv per procedure in the ambient (reference) dosimeter located at the C-arm.





Results: A total of 4900 interventional procedures with occupational and patient doses have been processed. The percentage of occupational doses higher than 0.5 mSv in only one single procedure, was between 0.1 and 0.5% of the procedures for the six interventional rooms. The percentage with >3 mSv per procedure at the reference dosimeter was between 0.2% and 3.2%. For the ratio between occupational doses (measured over the lead apron) and the dose value at the C-arm (without shielding), the alert to investigate was set for values higher than 10%.



Conclusions: The DMS with the integration of patient and occupational dose values allow the simultaneous management of both quantities and to set alerts identifying abnormal values of different dosimetric indicators to suggest corrective actions. Low, or medium dose values measured by the passive personal dosimeters are not always a guarantee of adequate occupational protection and the DMS with occupational doses, allow to manage several alerts for individual procedures helping to improve the personal protection.

As limitations for the obtained results it should be mentioned some inaccuracies in the scatter dose values measured by the ambient C-arm dosimeter when the dose rates are very high (e.g. for digital subtraction angiography acquisitions close to de scatter source).

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