

Recommendations of the Working Group on Interventional Cardiology on occupational doses to the lens of the eye in Interventional Cardiology

The International Commission on Radiological Protection (ICRP) published in April 2011 a statement that for the lens of the eye the threshold for tissue reactions is now considered to be 0.5 Gy. As a result ICRP recommended a new occupational dose limit for the lens of the eye of 20 mSv in a year. This recommendation has been incorporated into the interim version of the International Basic Safety Standards of the IAEA, published Nov 2011.

The new lower limit has important implications for some areas of occupational exposure, including interventional cardiology, emphasizing the need for optimization of protection measures with respect to the lens of the eye.

The nature of interventional cardiology is that if no protective measures for the eyes are used in an interventional cardiology laboratory, personnel with a typical workload would receive doses to the lens of the eye that would greatly exceed the dose limit, and over time could result in lens opacities.

Conversely, if the interventional cardiology equipment is performing correctly, procedure protocols have been optimized and protective tools for the eyes are being used, then the dose to the lens of the eye would be less than the dose limit, and likely to be a few mSv per year for a typical workload.

Results from ISEMIR surveys suggest that the use of protective tools and personal dosimeters are uneven, the quality of occupational dose monitoring is poor, and as a consequence knowledge about actual doses is limited. This has implications for the professionals, hospital or clinic management, and regulatory bodies.

WGIC of ISEMIR recommends:

- Training in radiation protection for all interventional cardiology personnel should include methods for reducing doses to the lens of the eyes, with practical exercises or demonstrations. Active dosimeters should be used in training.
- Interventional cardiology professionals working close to the patient must use a ceiling suspended protective screen, positioned appropriately. If the use of such screens is not feasible with a given procedure, lead glasses with side shields must be worn.
- Protective measures for interventional cardiology professionals working more distant from the irradiated volume of the patient should be specified by the local expert in radiation protection (e.g. radiation protection officer, medical physicist).
- Interventional cardiology professionals must always wear their personal dosimeters, following their local rules.
- Hospital management must perform continual reviews of personnel occupational eye doses.
- Personal dosimetry monitoring protocols must include assessment of the dose to the lens of the eye.
- Elements of a monitoring protocol should include the following:
 - The use of double dosimetry (over-apron at neck level and under-apron at chest/waist level);

- The use of ambient dosimeters (such as at the C-arm) in identifying the lack of compliance in wearing personal dosimeters and to help to estimate occupational doses when personal dosimeters have not been used;
 - The use of active dosimeters to identify means for improving radiation protection practice.
- Improved methodologies to assess lens doses need to be developed, including when lead glasses are worn.
- Industry should pursue the development of computational technologies (not requiring dosimeters), with personnel position sensing, to assess personnel doses, including eye doses.
- Manufacturers of interventional cardiology equipment should design their systems so that it is possible to provide a second ceiling suspended screen to afford protection for situations where personnel are working on both sides of the table.
- National dose registers should include records for lens of the eye dose assessments. Such records should include the occupation and function of the individual to enable identification of areas of concern.
- The ISEMIR International Data Base, under development, will be a useful tool for each interventional cardiology facility and regulatory bodies in benchmarking occupational eye doses in interventional cardiology in the future, and participation is recommended.