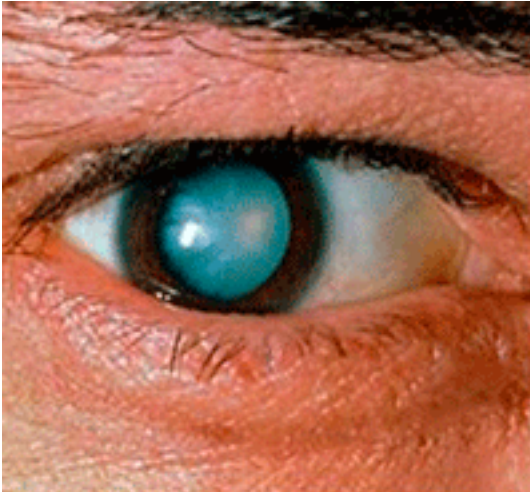


# Improving eye safety in Image Guided Interventional Procedures (IGIP)



Previously the International Commission on Radiological Protection (ICRP), in its publication 60 (1991) recommended annual limits for the lens of the eye at 150 mSv. However recent epidemiological evidence relating to tissue reaction effects for doses to the lens of the eye and possible cataract formation has seen the ICRP now recommend<sup>1</sup> an equivalent annual dose limit for the lens of the eye of 20 mSv, averaged over defined periods of five years, with no single year exceeding 50 mSv.

## [Improving eye safety in Image Guided Interventional Procedures \(IGIP\)](#)

### **Basis of health concern**

Limits on equivalent dose to the lens of the eye (and extremities and the skin) have been seen as necessary to ensure the avoidance of significant detrimental tissue and/or organ damage.

The new lower limit has important implications for some areas of occupational practice, including those procedures that involve image guided x-ray interventional procedures (IGIP), emphasising the need for optimisation of protection measures with respect to the lens of the eye. The IGIP applications of particular interest are those which require high dose angiographic acquisitions and/or CT fluoroscopy guided interventions.

The nature of IGIP is that if no additional protective measures for the eyes are applied, personnel with a typical workload may receive doses to the lens of the eye that would greatly exceed the new dose limit, and over time could result in lens opacities.

Equally, if the IGIP equipment is performing correctly, procedure protocols have been optimised and personal protective equipment (PPE) 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 a recent International Atomic Energy Agency survey of occupational dosimetry (ISEMIR<sup>2</sup>) suggest that the use of PPE 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 professions, hospital/clinic management, and regulatory bodies.

## **Recommendations**

- Training in radiation protection for all IGIP personnel should include methods for reducing doses to the lens of the eyes, with practical exercises or demonstrations. Real time dosimeters should be used in training.
- IGIP professionals working close to the patient should 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 should be worn. If appropriate, both devices should be used.
- Protective measures for IGIP 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).
- IGIP professionals should always wear their personal dosimeters, following their local rules.
- Hospital management should perform regular reviews of personnel occupational eye doses.
- Personal dosimetry monitoring protocols should include assessment of the dose to the lens of the eye.
- Elements of a monitoring protocol may 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 real time dosimeters to identify means for improving radiation protection practice.
- Manufacturers of interventional equipment should be able to supply systems that 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.

## **Conclusion**

The ICRP has maintained the previous judgment that acute doses up to approximately 0.1 Gy produce no functional impairment of tissues. The risks of radiation-induced cancer and hereditary effects continue to be the principle risks to consider for most applications in occupational situations. However, after acute or accumulated doses of more than 0.5 Gy, the risk of tissue effects becomes increasingly important for the lens of the eye after prolonged periods of time following radiation exposure.

There is no indication that protracted delivery of the dose to the lens of the eye is less damaging than acute exposure.

It is therefore recommended that owners, operators and ancillary staff take appropriate measures to ensure the limitation of this exposure by applying the above recommendations.



*Photo: Cardiac catheterisation laboratory at the San Carlos University Hospital in Madrid*

- 1 ICRP ref 4825-3093-1464 Statement on Tissue Reactions.
- 2 [www-ns.iaea.org/tech-areas/communication-networks/orpnet/isemir-wgic.asp](http://www-ns.iaea.org/tech-areas/communication-networks/orpnet/isemir-wgic.asp).