Professional organisations, radiation protection priorities and project collaboration
CIRSE – Cardiovascular and Interventional Radiological Society of Europe

Cataract awareness

CIRSE Radiation Protection Subcommittee
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We see the risk

30 – 50% of Interventionists develop lens opacities if working without eye protection. Recent research findings indicate a significant risk of developing lens opacities (cataracts) as a consequence of occupational exposure experienced by medical professionals performing fluoroscopical interventions.
In a recent study conducted at a medical congress, posterior subscapular lens changes characteristic of ionising radiation exposure (see Fig. 1) were found to be prevalent amongst interventional catheterisation professionals.

A real health risk. The interventionists with detectable opacities had been exposed to a significantly higher estimated cumulative lens radiation dose over the course of their careers (8.3 Gy ± 5.4) than those without (3.0 Gy ± 2.9). The severity of lens opacification was also found to correlate with the absorbed dose (see Fig. 3).
Far from being harmless, these opacities are particularly associated with decrements in contrast sensitivity (see Fig. 4a/b) and may be associated with greater future visual disability[1].

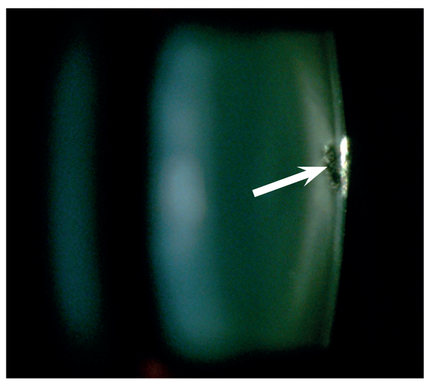


Fig. 1: Subcapsular posterior cataract, noted after 22 years of work in a catheterisation laboratory. Arrow shows a 1.5 opacity.

Fig. 2: Lead aprons, personal dosimetry and protective goggles are essential protective tools for the interventionalist.

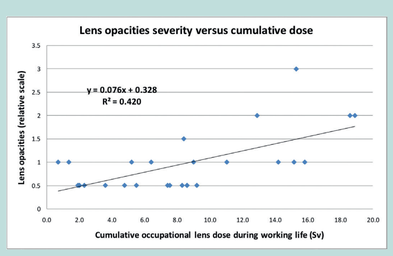


Fig. 3: Correlation between the severity of lens opacities and cumulative occupational radiation dose over an interventionist's work life.

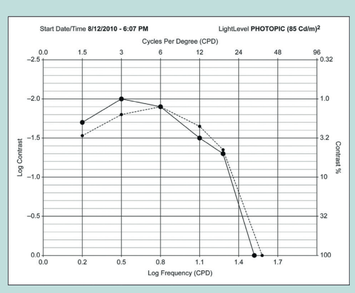


Fig. 4a: Contrast sensitivity measured for an individual with normal contrast sensitivity. The curve (solid line) matches the curve of the hypothetical normal contrast sensitivity function (dotted line).

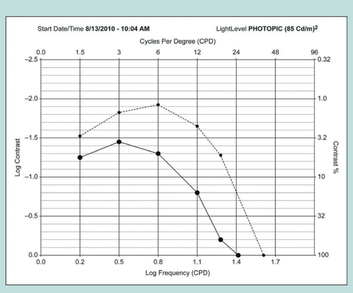


Fig. 4b: An interventionist's measurements, which show a significant loss of contrast sensitivity. The subject's curve (dotted line) is significantly different from the normal contrast sensitivity curve (solid line).

ICRP & EU: new limit for occupational exposures

In 2011 the International Commission on Radiological Protection (ICRP) brought attention to the fact that tissue reaction effects can occur following lower exposures than previously thought: 0.5Gy, 10 times lower than earlier estimates.
Accordingly, the ICRP has recommended a new occupational exposure limit of 20mSv per year, averaged over 5-year periods, during which no single year may exceed 50mSv. The European Union is set to enshrine this limit in an upcoming radiation protection directive[2].
For more information on scientific guidance provided by the ICRP, visit rpop.iaea.org. We highly recommend their freely available *10 Pearls: Radiation Protection of Patients/Staff in Fluoroscopy.*

Am I at risk?

How well am I protected?
A recent study in Germany measured the effectiveness of radiation protection tools for the eye lens dose during standard fluoroscopic interventions (see Fig.5).
The exposure of the lens of about 100 – 550 microSv during radiologic interventions is only reduced marginally by solely relying on under-table shielding. Adding mounted screens, especially suspended lead glass shields, greatly reduces the exposure, if adequately adjusted during the procedure to provide lateral protection and shield the face.
Lead goggles complete the ideal protection for an IR, reducing exposure that has passed other shielding to minimum levels and protecting the eyes during manoeuvres where other protection is impossible or impractical[3].

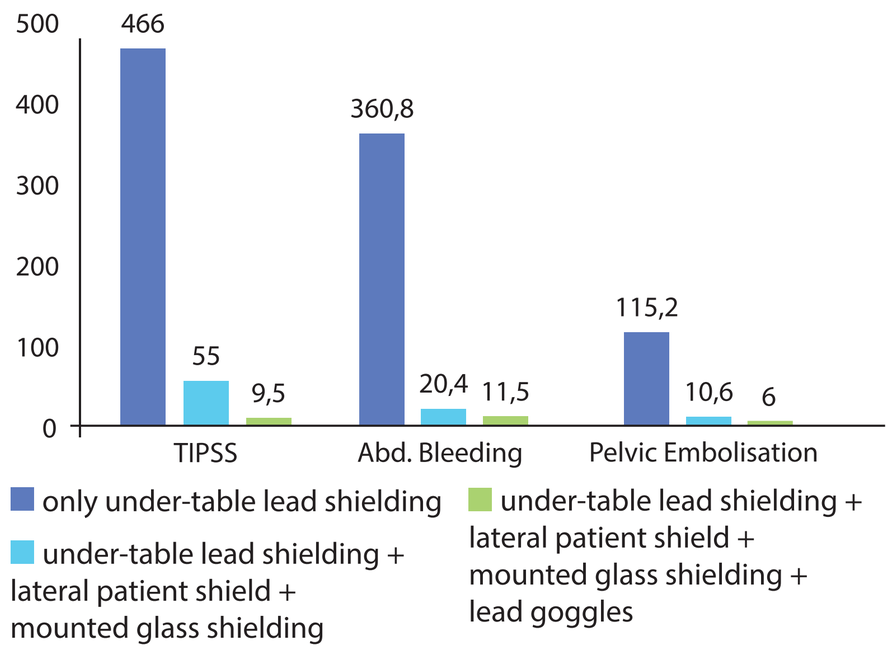
Don't take the risk

How can I avoid radiation-induced lens injury? Interventional radiologists must take particular care of their eyes, due to their regular performance of high-dose procedures. During some fluoroscopically-guided procedures, the IR is very close to the irradiated volume of the patient, sometimes with limited possibility of self-protection.
Up-to-date training, conscientious use of protective tools and careful dosimetry to evaluate lens dose must be pursued to maintain the health and functionality of the eye.

5 points that will keep your eyes safe

- **Continued medical education:** regularly update your radiation protection training.
- **Observe radiation protection standards of practice:** occupational recommendations published by scientific medical societies should be followed.
- **Use the appropriate radiation protection tools:** in particular ceiling suspended screens (in correct position), mounted table shielding and protective eyewear
- **Use personal dosimeters:** one under the lead apron and a second over the apron to be able to estimate eye dose.
- **Regularly have your eyes examined:** a full ophthalmologic check with a detailed slit lamp examination of the posterior lens region is recommended.

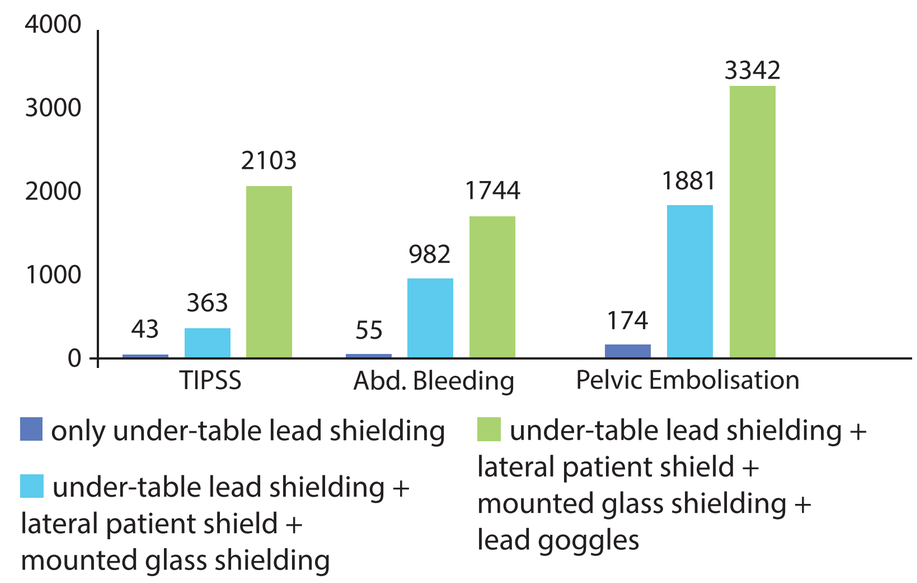
Fig. 5: Average eye lens dose (in microSv/ procedure) according to procedure and protection tools used



An avoidable risk.

Is adequate protection achievable?
Fig. 6 shows an estimation of the number of procedures required to reach the newly proposed annual exposure limit of 20 mSv per year, depending on the protection used.
If conscientious protection of the eyes involving mounted shields, goggles and personal dosimetry is observed, IRs can easily manage to stay below the newly recommended occupational exposure limit of 20 mSv per year, even when performing frequent high dose procedures.
Only if you stay below this limit can you reduce the health risk to your eyes to an acceptable minimum according to the current scientific status quo.[3]

Fig. 6: Number of procedures necessary to exceed 20 mSv annual limit according to procedure and protection used.



[1] Radiation-associated lens opacities in catheterization personnel: results of a survey and direct assessments. Vano E, Kleiman NJ, Duran A, Romano-Miller M, Rehani MM. J Vasc Interv Radiol. 2013 Feb;24(2):197-204
[2] European Commission. Proposal for a Council Directive laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation. Brussels, 30.05.2012. Com (2012) 242 final.
[3] Exposition of the Operator's Eye Lens and Efficacy of Radiation Shielding in Fluoroscopically Guided Interventions. Galster M, Guhl C, Uder M, Adamus R, Fortschr Röntgenstr (RöFo) 2013; 185: 474–481ionising radiation. Brussels, 30.05.2012. Com (2012) 242 final.