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Interventional Radiology Working Group

Guidance on eye protection in interventional procedures

Virginia Tsapaki (Konstantopoulio General Hospital, Athens, GR)
Tommy Berglund (St. Olavs University Hospital, NO)
Philipp Wiggermann (University Hospital Regensburg, GER)

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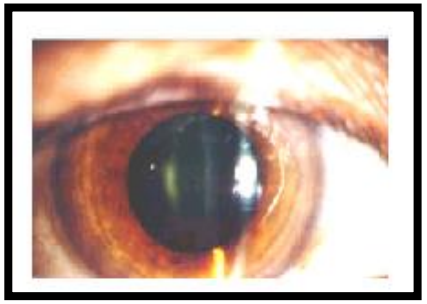
Background:
New eye lens dose limit

- ICRP revised the **eye dose threshold** for cataract induction. This is **0.5 Gy**, (previous limit: 5 Gy for acute exposures and > 8 Gy for highly fractionated doses (1).
- ICRP also recommended a reduction in the **equivalent dose limit** for occupational exposure from **150 mSv to 20 mSv in a year**, averaged over defined periods of 5 years.
- This is included in the IAEA International Basic Safety Standards (2), and in the new Council Directive 2013/59/Euratom (3) which must be implemented by the Member States by February 2018.

Background:
Data from recent literature

Vano 1998



- Many reports have demonstrated that the occupational ocular dose may exceed the new annual limit if radiation protection equipment is not used.
- There is a **strong correlation** between radiation induced **cataract** and exposure to medical staff working in IC **when the protection tools are not used** (4).
- Eye lens changes appeared to 38% of interventional cardiologists, 21% of nurses and 12% of unexposed controls (5).
- Cumulative **eye dose** for the catheterization laboratory staff ranged from **0.1 to 18.9 Sv** (6).

INTERNATIONAL RADIATION PROTECTION ASSOCIATION. IRPA guidance on implementation of eye dose monitoring and eye protection of workers

- Doses to the lens of the eye of the staff can be important during interventional radiology and cardiology procedures.
- As regards protection of the eyes in the medical field, the following table summarizes the protection recommendations depending on the annual dose (4).

Tissue	Annual unprotected dose (mSv)	Protection recommendations
Eyes	3–6	Ceiling suspended screens should be used where available. Protective eyewear may be considered where there is no other protective device.
Eyes	> 6	Protection essential. Both ceiling suspended shield and protective eyewear should be considered and at least one form used. Training should be given in use of ceiling-suspended screens where these are provided

What are the most important radiation protection devices for IR and IC procedures?

- Ceiling suspended screen
- Lead glasses
- Both

- If one must be used, then the screen is preferable as it protects all upper part of body.
- In cases where the screen cannot be used then lead glasses must be worn.

Ceiling suspended screens.

Simple steps for more effective protection:

- Staff should be trained in optimal use of ceiling suspended screens, before commencing interventional work.
- The training should include correct positioning linked to the different positions of the x-ray tube with respect to operator positions.
- **It is more effective when positioned close to patient skin and to x-ray field.**
- It can provide good protection for the whole head, but this depends on effective use through repositioning whenever the x-ray tube or patient couch are moved.

Lead glasses

- Leaded eyeglasses with large lenses and protective side shields provide more protection than eyeglasses without these features.
- They help to minimize scatter which approaches the operator from the side and scatter from the operator's own head.
- The principal disadvantage of leaded eyeglasses is their weight and discomfort.

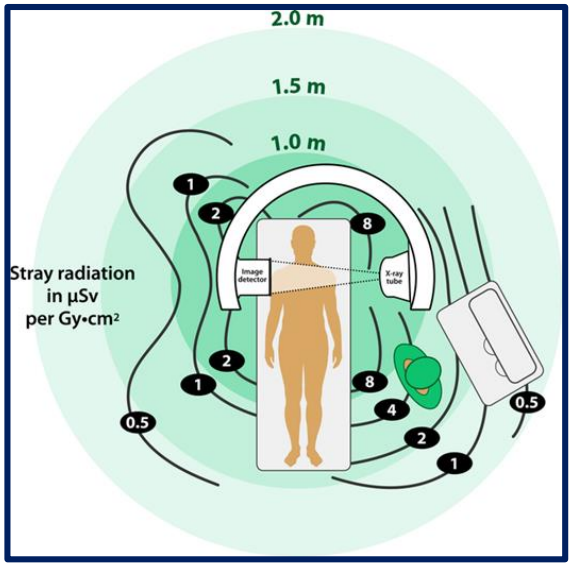
Lead glasses.

Simple steps for more effective protection:

- If annual doses are over 6 mSv regular use of protective eye wear must be considered.
- Lead glasses can provide dose reduction factors up to 4-5.
- Different models of lead glasses with various shapes, sizes and lead thickness should be evaluated before their use.
- The evaluation should include radiographic or fluoroscopic inspection to confirm that the side shielding is adequate.
- A trial period is also needed for potential wearers to ensure the closeness of the fit and the comfort in wearing.
- If there is no specific data available for measurements of the dose reduction, then a factor of 2 may be applied provided the eyewear is of an approved design with either side shields or a wraparound design.

When do we need eye monitoring?

Who answers this question?



- Risk assessments should be carried out to identify workers for whom exposure of the lens of the eye might be important.
- The risk assessment must be carried out by a qualified expert.
- In case of eye monitoring is needed, there are special eye dosimeters.

Eye dosimeters

Various eye dosimeters

There are many services for eye lens dosimeters. The basic structure is the same:

- a thermoluminescent detector,
- sufficient filtration, and
- a holder to help the dosimeter to be placed as close as possible to the eye lens.

Summary

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Guidance on eye protection in interventional procedures

Summary

- Staff should be trained in optimal use of ceiling suspended screens, before commencing interventional work.
- It is more effective when positioned close to patient skin and to x-ray field.
- If annual doses are over 6 mSv regular use of protective eye wear must be considered.
- The evaluation should include radiographic or fluoroscopic inspection to confirm that the side shielding is adequate.
- A trial period is also needed for potential wearers to ensure the closeness of the fit and the comfort in wearing.
- A risk assessment by a qualified expert should be carried out to identify workers for whom exposure of the lens of the eye might be important.

References

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