



Recommendations

- Interventional Radiology and Cardiology

J. Domienik^{1,*}, M. Brodecki¹, E. Carinou², L. Donadille³,
J. Jankowski¹, C. Koukorava², S. Krim⁴, D. Nikodemova⁵,
N. Ruiz-Lopez⁶, M. Sans-Mercé⁶, L. Struelens⁴ and F. Vanhavere⁴

¹Nofer Institute of Occupational Medicine, Lodz, Poland

²Greek Atomic Energy Commission (GAEC), Greece

³Institut de Radioprotection et de Sûreté Nucléaire (IRSN), France

⁴Belgian Nuclear Research Centre (SCK•CEN), Belgium

⁵Slovak Medical University Faculty, Bratislava, Slovakia

⁶Institute of Radiation Physics (IRA), University Hospital Center and University of Lausanne, Switzerland

PURPOSE

The final outcome of the ORAMED project is to propose, on the basis of the results of measurement and simulation campaign performed, the guidelines that will minimise radiation risk to interventionists and assisting staff.

Directed to:

- physicians
- nurses
- technicians (radiographers) and
- RP officers

The following recommendations concern only radiation protection aspects.

BULLETS

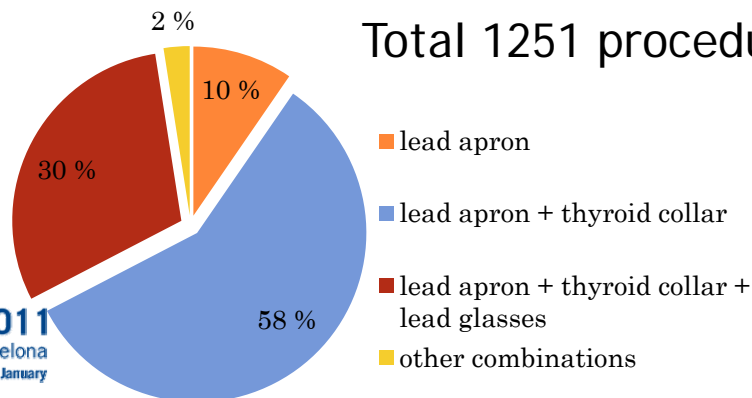
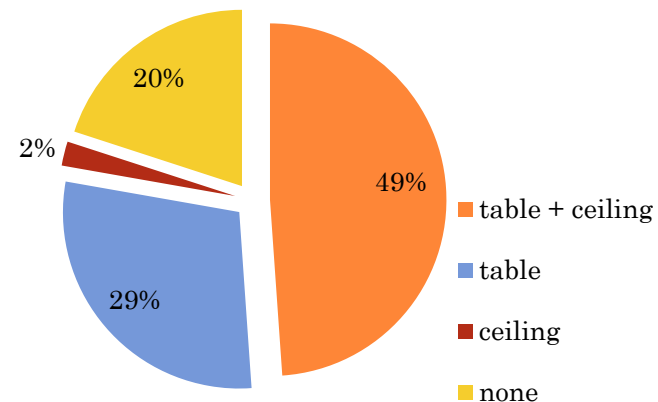
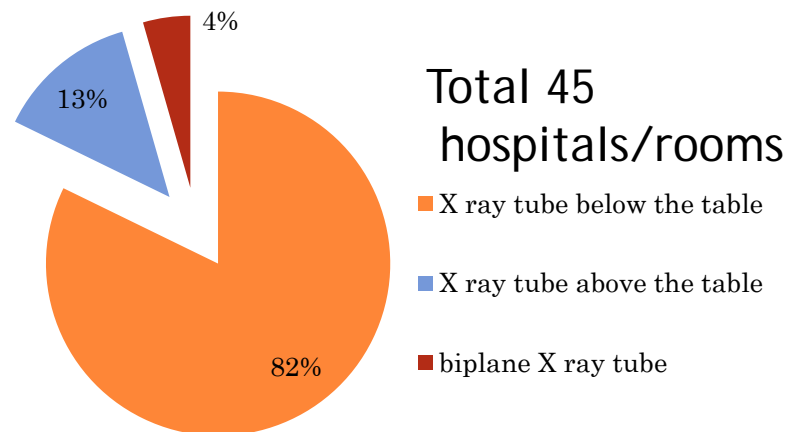
1. Only dedicated interventional radiology equipment should be used.
2. The room protective equipment should be used whenever it is practicable and it should be always adjusted-positioned properly.
3. The tube should be placed below the operating table when C-arm systems are used. If the biplane tube configuration is used the proper use of lateral shield is very important for the protection of the eyes and hands.
4. The physician should stand as far as it is practical from the source of scattered radiation (the patient and the X-ray tube).
5. Using the automatic contrast injection system and going outside the operating room during the image acquisition is a practice which can reduce the doses significantly.
6. Avoid the direct exposure of hands to primary radiation.
7. Routine monitoring of doses to hands or wrists as well as to the eye lens.

RECOMMENDATION 1

EQUIPMENT

• Only dedicated interventional radiology equipment with adequate protective measures should be used:

- ✓ under-couch X-ray tube is preferred
- ✓ protective shields (table shield, ceiling shield, RP cabine etc.)
- ✓ personal protective equipment (lead apron, thyroid collar, lead glasses etc.)



Other protective equipment:

Lead glasses	- 392 (procedures)
RP cabine	- 20
Gloves	- 14
Legs	- 3

RECOMMENDATION 2

ROOM PROTECTIVE *EQUIPMENT* - *ceiling shield*

- When ceiling shield is not available the protective glasses should be used by the operator and the assisting staff. Most effective are the ones with large lens having high lead content and side shields.

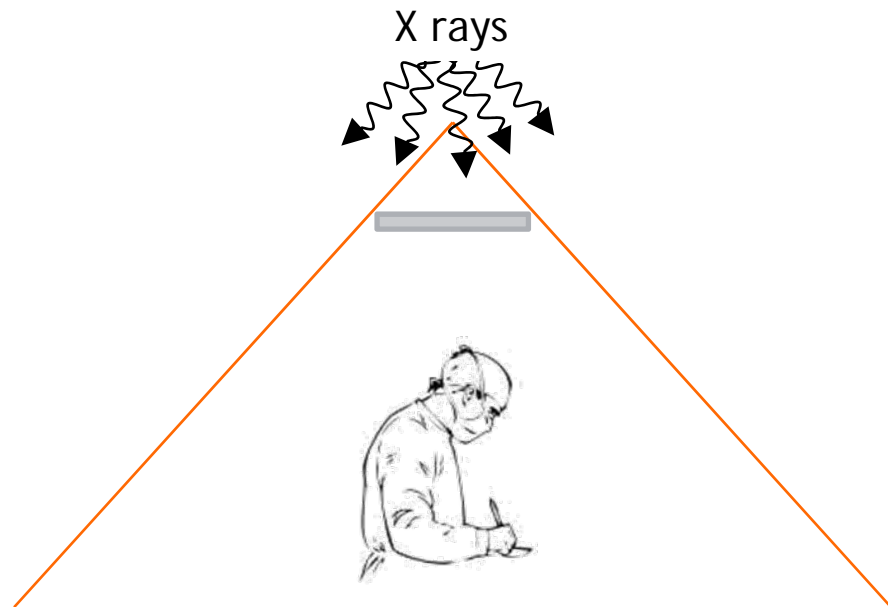
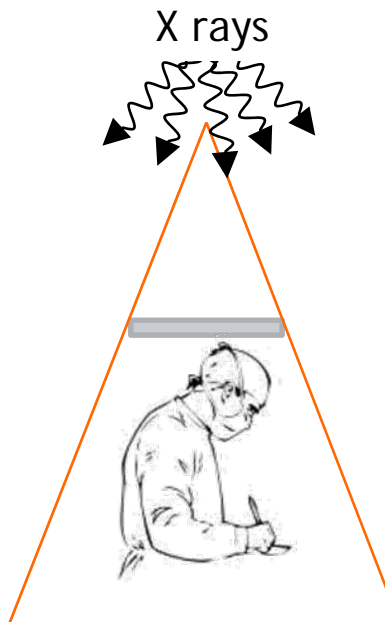


Side view fully protected

RECOMMENDATION 2

ROOM PROTECTIVE *EQUIPMENT* - *ceiling shield*

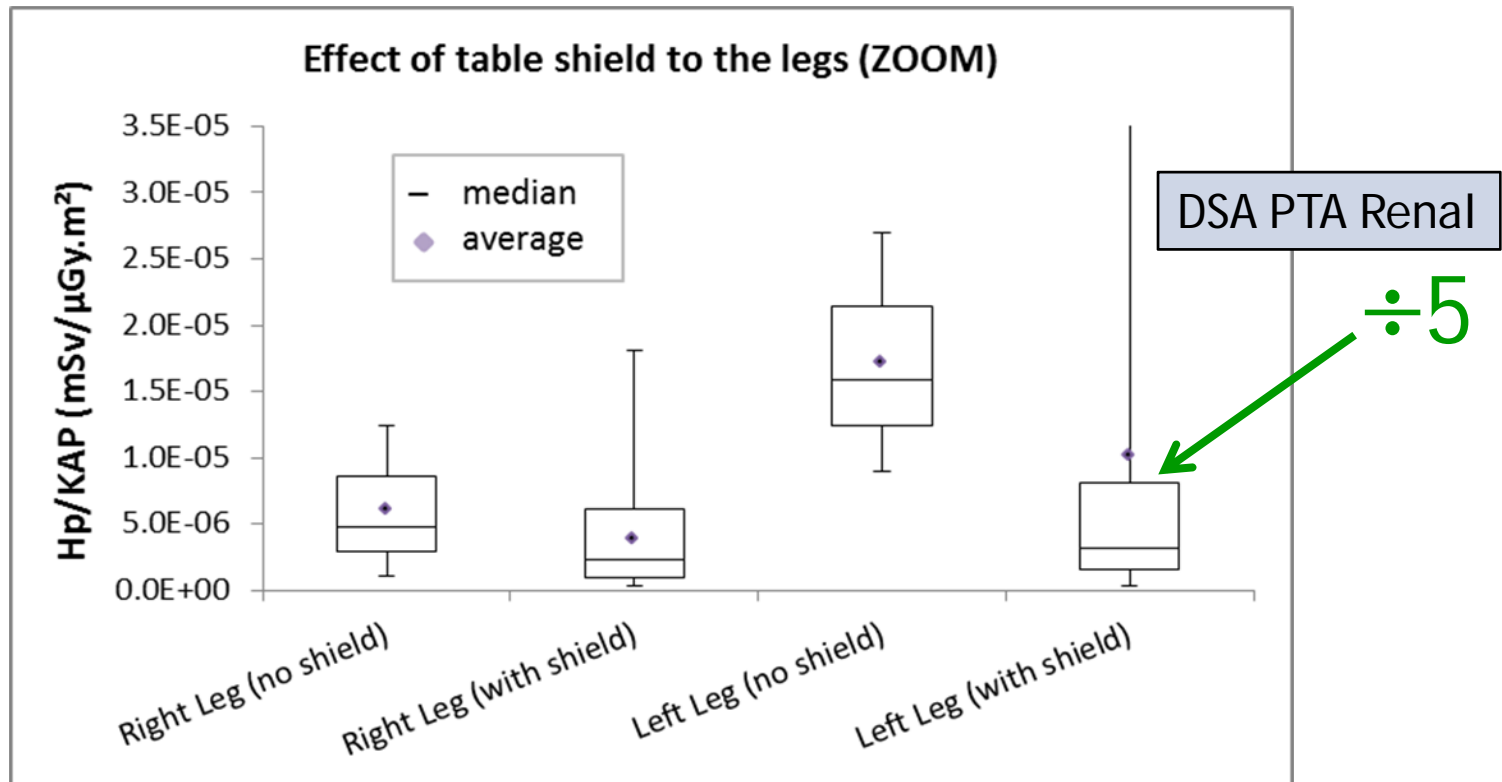
- The ceiling shield should be placed close to the source of scattered radiation.



RECOMMENDATION 2

ROOM PROTECTIVE EQUIPMENT - table shield

- The table shield should be always properly adjusted to protect both legs. The proper positioning of the table shield is very important for the assistant as well, who, in many cases, stands close to the main operator but his legs are not protected.
- There are also cases where the operator needs to change his position (e.g. when he has to change the access or even the side) during the procedure without having his legs protected. The proper use of table shield can reduce the leg doses from 2 to 5 times.



RECOMMENDATION 2

ROOM PROTECTIVE *EQUIPMENT* - *table shield*



RECOMMENDATION 3

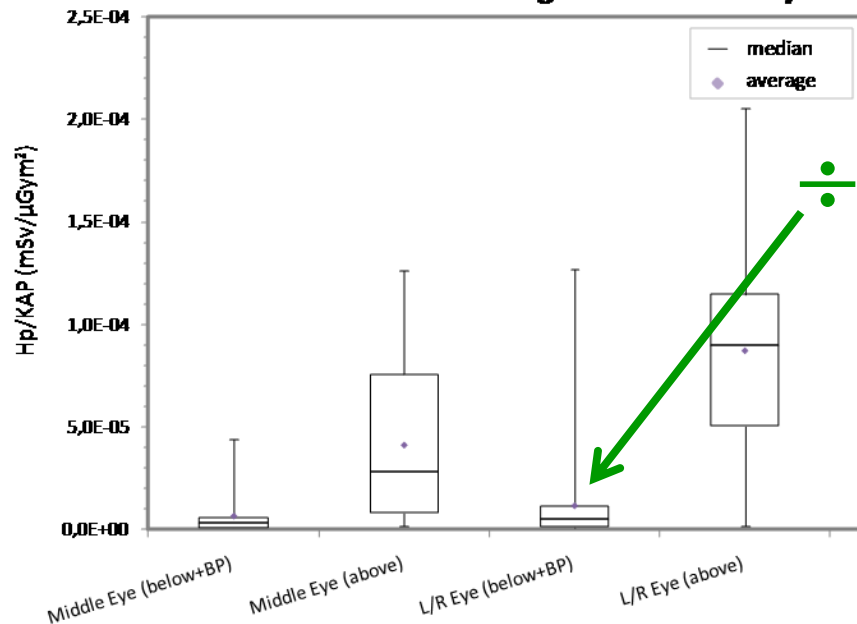
X-RAY TUBE CONFIGURATION

- The tube should be placed below the operating table. There is a significant reduction at the eye (2-17 times) and hand doses (2-50 times). However, there is an increase at the leg doses which can be compensated by the use of properly positioned table shield.
- If the biplane configuration is used the proper use of lateral shield is very important because otherwise the eyes and hands are practically unshielded.

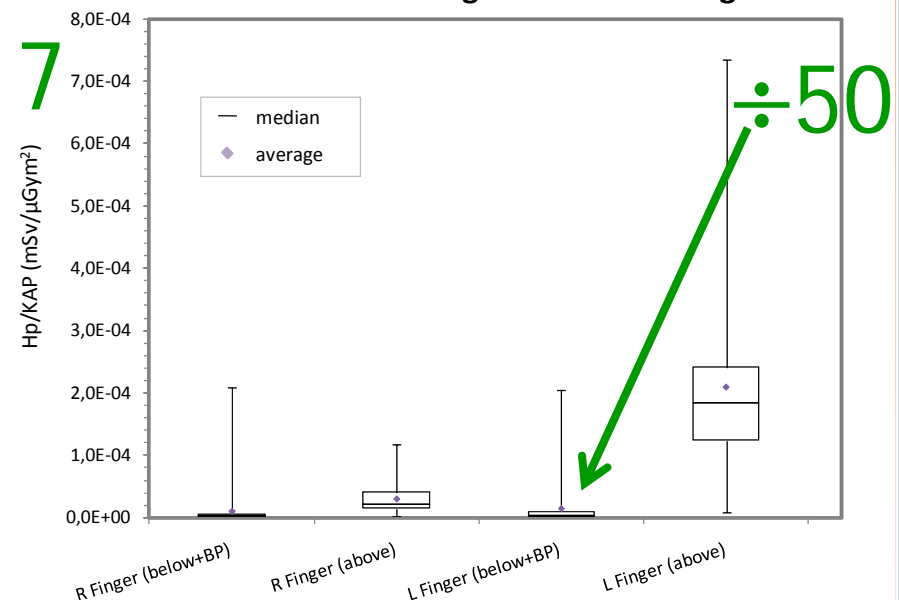


Embolisation

Effect of tube configuration to the eyes



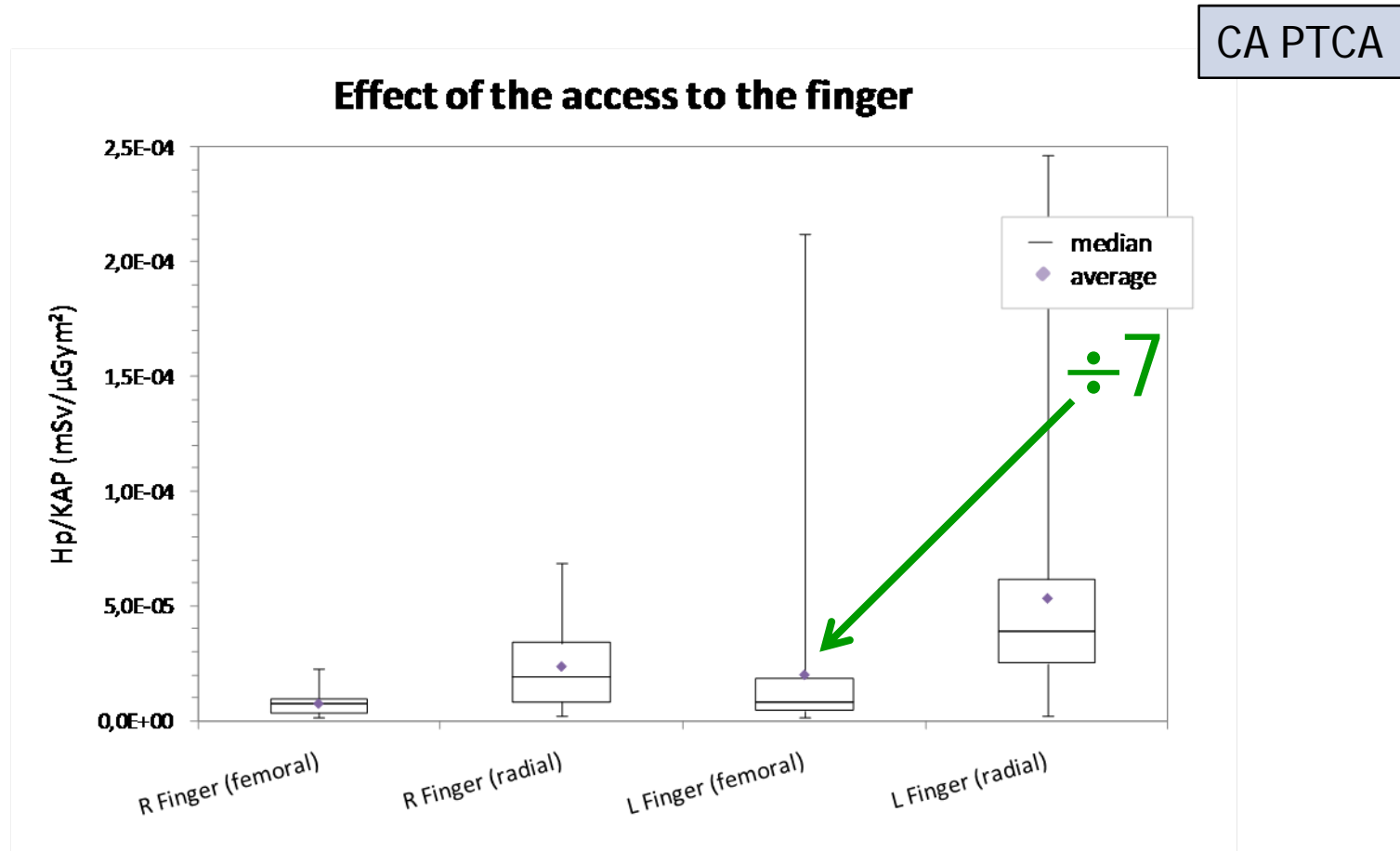
Effect of tube configuration to the fingers



RECOMMENDATION 4

OPERATING FACTORS

- The operator should stand as far as it is practical from the source of scattered radiation.
- For CA PTCA procedures the femoral access leads to lower doses than the radial access. In the former case the doses can be lower 2 to 7 times.

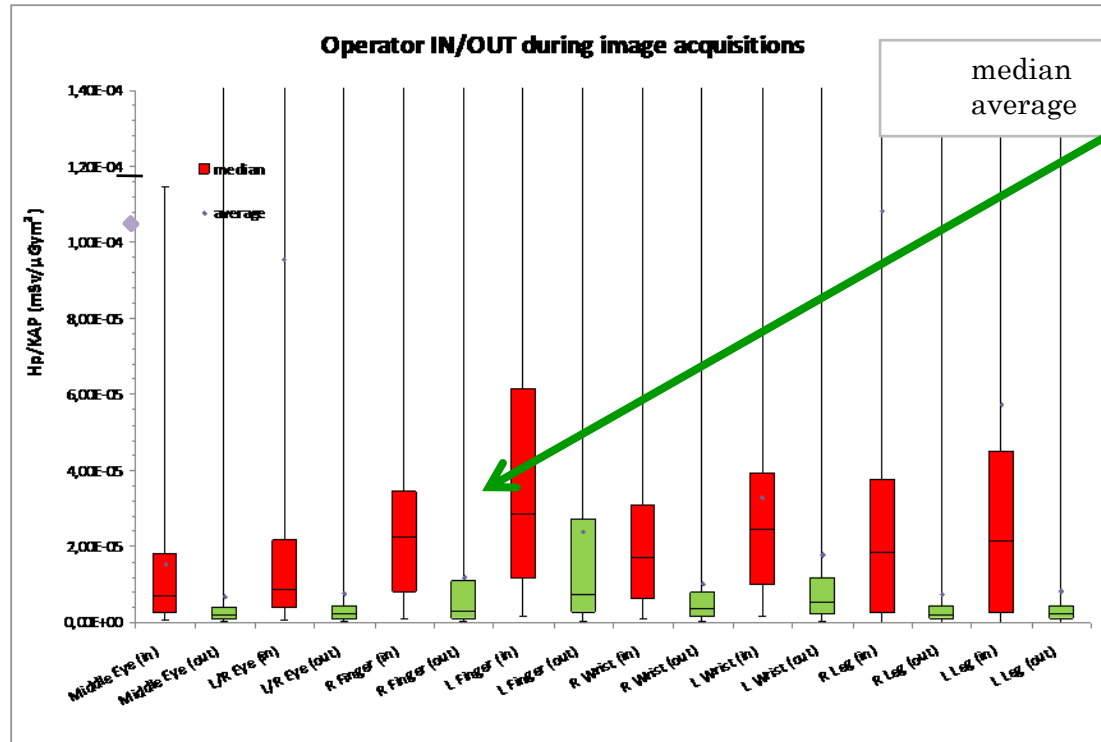


RECOMMENDATION 5

OPERATING FACTORS

- Using automatic contrast injection and going outside the operating room during the image acquisition is a practice which can reduce the doses significantly (4 to 7 times), especially to the hand ones.

DSA PTA LL



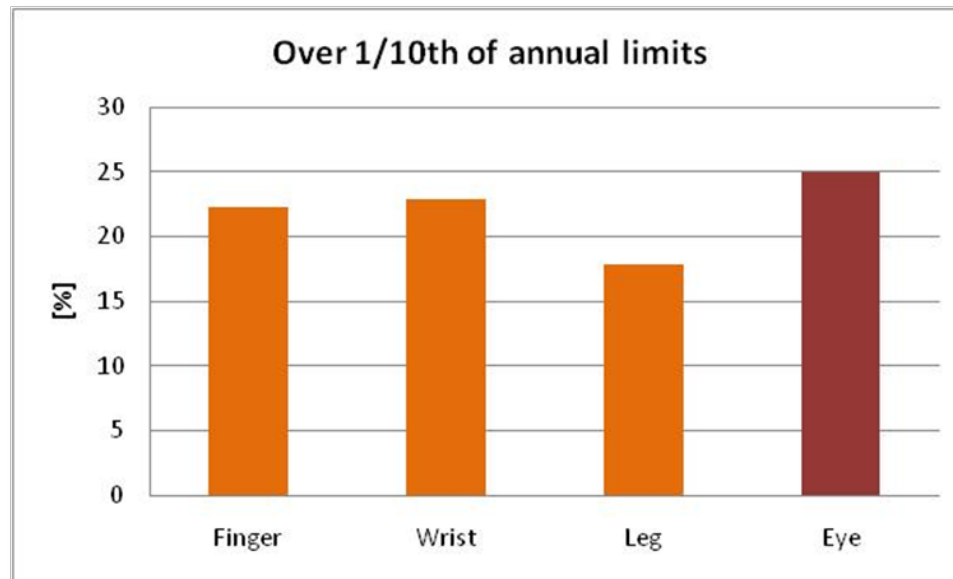
- Avoid the direct exposure of hands to primary radiation.



RECOMMENDATION 6

ROUTINE MONITORING

- Routine monitoring of doses to hands or wrists as well as to the eye lens.
 - ✓ In the procedures that were examined the **left wrist** was found to be the position with the maximum dose and then the **left finger** (for embolizations, DSA PTA LL and pacemakers).
 - ✓ The maximum doses were measured at the **left wrist for the femoral access** and at the **left finger when the radial access** is used or when the operator's hands are very close to the beam field.
 - ✓ However, when the annual limits are taken into account the maximum exposure is observed for the eyes for most of the procedures (the exception are Pacemaker and CA PTCA procedures).
 - ✓ So ring or wrist and eye lens dosimeters are important for routine monitoring.



Thank you for your attention

