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NEWSLETTER #16

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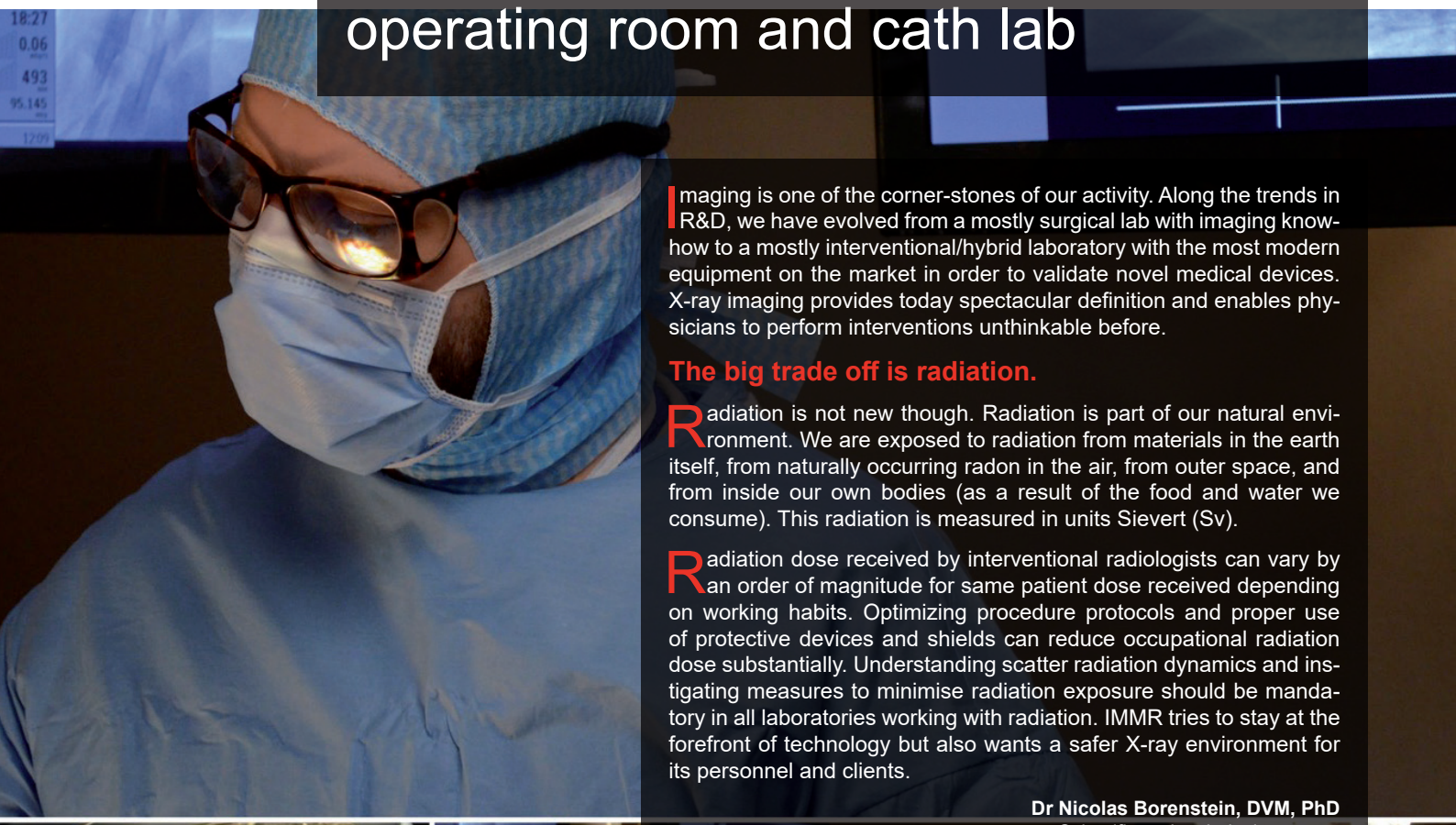
Radiation dose optimization in the operating room and cath lab



Imaging is one of the corner-stones of our activity. Along the trends in R&D, we have evolved from a mostly surgical lab with imaging know-how to a mostly interventional/hybrid laboratory with the most modern equipment on the market in order to validate novel medical devices. X-ray imaging provides today spectacular definition and enables physicians to perform interventions unthinkable before.

The big trade off is radiation.

Radiation is not new though. Radiation is part of our natural environment. We are exposed to radiation from materials in the earth itself, from naturally occurring radon in the air, from outer space, and from inside our own bodies (as a result of the food and water we consume). This radiation is measured in units Sievert (Sv).

Radiation dose received by interventional radiologists can vary by an order of magnitude for same patient dose received depending on working habits. Optimizing procedure protocols and proper use of protective devices and shields can reduce occupational radiation dose substantially. Understanding scatter radiation dynamics and instigating measures to minimise radiation exposure should be mandatory in all laboratories working with radiation. IMMR tries to stay at the forefront of technology but also wants a safer X-ray environment for its personnel and clients.

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Scientific and technical manager
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We live in a radioactive world. The average dose per person from all sources is about 2.5-3.5 mSv per year (85% from natural sources, the rest is medical scans). As an example, chest X-ray is 20 µSv, an airplane flight Los Angeles to New York City is 40µSv, a yearly dose from natural potassium in the body is 390 µSv, a chest CT-scan is 6-30 mSv (note, 1 mSv is 1000 µSv!) which is roughly what an individual would get from one hour near the Chernobyl power plant in 2010. A radiation worker yearly limit dose is 50 mSv in the US and 100 mSv is the lowest yearly dose ever linked to increased risk of cancer. Very severe radiation poisoning over a short period is reached at 2 Sv (=2000 mSv). Fatal dose is reached at 8 Sv. This is just a quick overview such that everyone gets a sense of relative risks but the important aspect somewhat not obvious from the above values is time of exposure. Everyone is exposed daily to radiation without any particular knowledge or concern for an increased risk but repetitive professional exposure has to be well controlled and understood by the people involved.

Most countries have legal approach to radiation professional hazards. In France, 20 mSv is the maximal dose acceptable per year for physicians working in interventional radiology. Way before cancer, interventional cardiologists who work every single day in the cathlab have a much increased risk of developing subcapsular cataract, eyes being generally not protected.

We are particularly sensitive to occupational hazards and protecting our staff and clients.

In order to manage radiation exposure, we have implemented several rules in the OR when using X-rays. An important goal of all interventional fluoroscopy is to achieve clinical success using the least amount of radiation consistent with adequate imaging guidance.

Although we are not subject to the same level of scrutiny for patient radiation in our particular preclinical activity, optimizing patient radiation dose also provides a direct benefit to the operator and assistants: scattered radiation in the room is directly proportional to the patient dose. If patient dose is reduced, so is the dose to the operator.

Our hybrid OR is well adapted to best managing exposure in that imaging is so good that it can be kept to a minimal level of radiation but still having excellent guidance. Further, the room is large, there are two different lead shields and under table radiation protection with curtains.

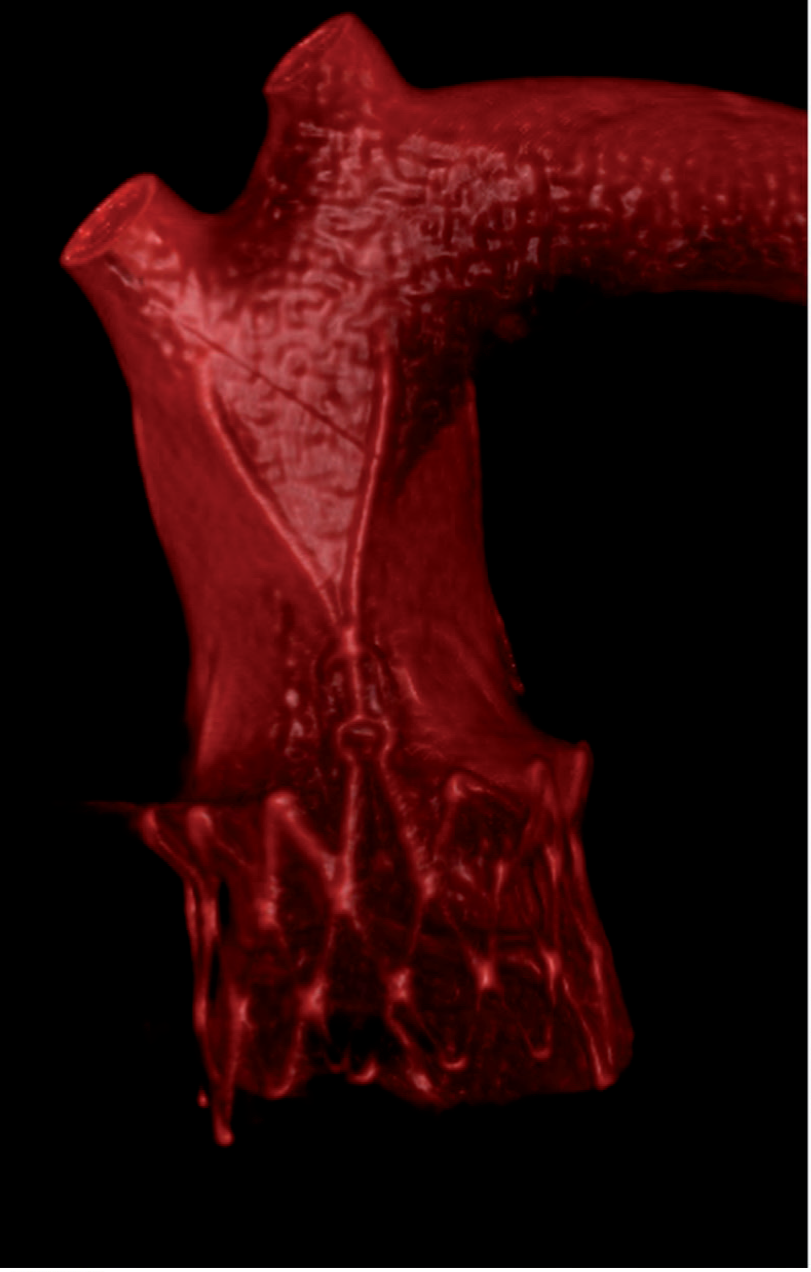
How to best manage scatter radiation in the OR?

Use proper radiologic technique

- Maximize distance between x-ray tube and patient
- Minimize distance between patient and image receptor
- Limit use of electronic magnification
- Control fluoroscopy time
- Limit use to necessary evaluation of moving structures
- Employ last-image-hold to review findings
- Control images
- Limit acquisition to essential diagnostic and documentation purposes
- Reduce dose
- Reduce field size (collimate) and minimize field overlap
- Use pulsed fluoroscopy and low frame rate

Protection of personnel

- Keep hands out of the beam
- Use movable shields
- Maintain awareness of body position relative to the x-ray beam
- Horizontal x-ray beam – operator and staff should stand
- on the side of the image receptor (it may sound surprising but it is clearly shown with studies of isoline of scattered radiation)
- Vertical x-ray beam – the image receptor should be above the table
- Wear adequate protection
- Protective well-fitted lead apron and leaded glasses



PHILIPS

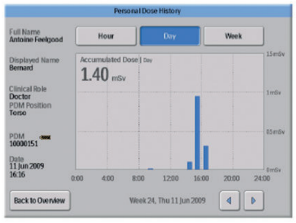
The DoseAware System

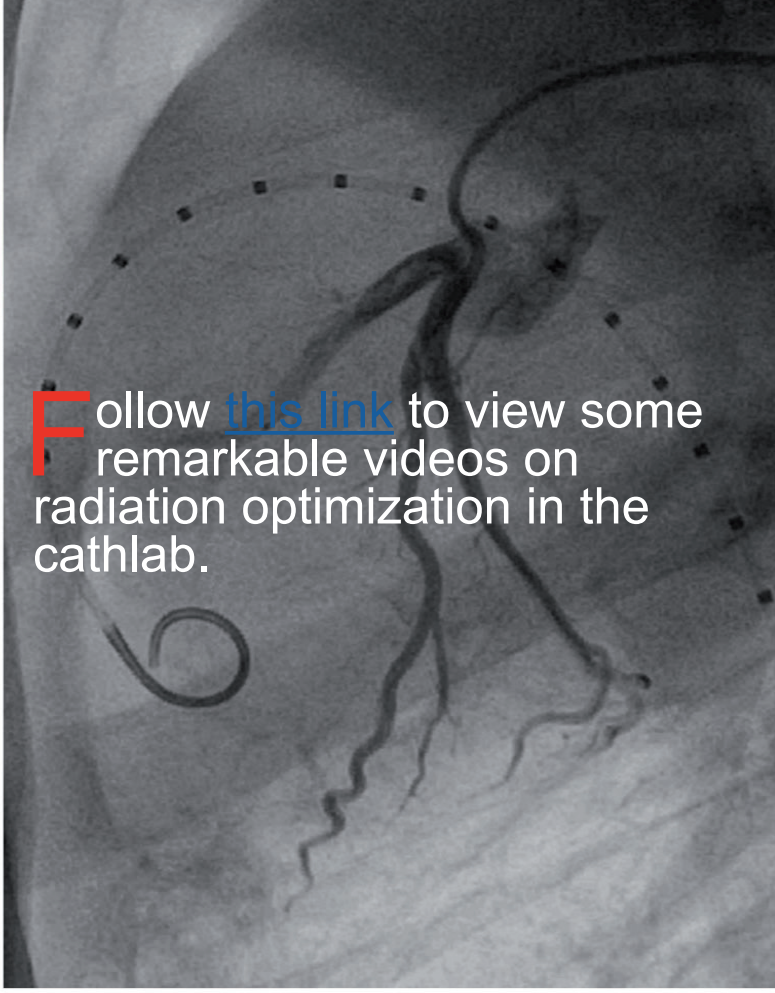
Base Station: real-time display

Three zones:

- **Green** good working habits
- **Yellow**: higher doses
- **Red**: take actions to minimize the dose exposure.

Walk up view read out for single PDM





Follow this link to view some remarkable videos on radiation optimization in the cathlab.

Finally, we have recently implemented a new radiation protection equipment from Philips healthcare called Dose Aware. This original dosimetry system enables real-time monitoring of one's radiation exposure and promotes therefore a healthier X-ray environment. Dose Aware is a great tool to make the invisible visible and therefore improves radiation dose awareness and facilitates positioning in a low-scatter area. The dosimetry badges are worn on top of the lead aprons and give the real instant radiation exposure. This system can be made available to our customers upon request. This system bares no legal value in that it cannot replace occupational radiation exposure management with official dosimeters worn under the apron (optically stimulated luminescence dosimeters and or electronic dosimeters, of note, all IMMR personnel working with radiation bear one or two of them) but is a very valuable tool for exposure optimization.◆

Editor
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Videos and previous newsletters on our services are available online here:

www.imm-recherche.com