

## Radiation exposure in interventional cardiology

Robert Steiner<sup>1\*</sup>

<sup>1</sup> University Hospital Centre Osijek, Osijek, Croatia

\* Corresponding author phone: +385 (31) 511-511, e-mail: [steiner\\_robert5@hotmail.com](mailto:steiner_robert5@hotmail.com)

### Abstract

Radiation exposure rises with growing number of computed tomography, nuclear cardiological exams, coronary angiography and fluoroscopy leading to a higher risk of patient overexposure to radiation. It is estimated that 40% of radiation exposure is due to cardiological procedures. Interventional cardiologists and cardiac electrophysiologists are two to three times more exposed to radiation than diagnostic radiologists. In high volume cath labs the most experienced interventional cardiologists have annual exposure about 5mSv and lifetime exposure increases cancer risk by 1%. There are two main biological effects of radiation: tissue reaction (deterministic effects) that becomes evident days or months after exposure and include skin injuries and cataract, and stochastic effect which is related with potential and future harm damaging DNA or indirectly (free radicals and reactive oxygen species) leading to cancer manifestation after many years. Increased cancer risk is for doses more than 50mSv. Risk is 3-4 times higher in children than in adults, 38% higher in females than in males, 50% lower in octogenarians than in 50 year-old old patients. Some tissues are more sensitive than others. Highest radiosensitivity organs are breast, colon, lung and stomach.

Patients and doctors protection can reduce the radiation exposure by 90%. Radiation doses in cath lab depend on operator experience, arterial approach, distance of image intensifier from patient, cine-duration, performing ventriculography or not, projection, magnified views and also some patient characteristics: BMI, coronary lesion type and sort of arrhythmia to be ablated as maintained and quality controlled technology.

In our investigation we compared doses of exposure to patients and operators in 2007 compared with 2009 and found that as we had more experience and awareness of harmful effect of radiation, doses were lower and 2.7% of patients had exposure more than 2Gy and they are included in the follow up. Doses were similar to other cath labs.

We need more epidemiological, and biodosimetry data on radiological protection in patients (children and adults), interventional cardiologists and staff (including genetic studies), non-cancer effects, innovative devices and procedures.

Table 1. Standard reference doses for common cardiological examinations

Diagnostic procedure	Effective dose (mSv)	Equivalent number of PA chest radiography each (0.02mSv)	Approximate equivalent period of natural background radiation (years)
Chest X-ray	0.02	1	0.008
Coronary angiography	7 (2-16)	350 (100-800)	2.9
Percutaneous coronary intervention	15 (7-57)	750 (350-2800)	6.3
Radiofrequency ablation	15 (7-57)	750 (350-2800)	6.3
Dilatation chronic coronary occlusion	81 (17-149)	4050 (850-9600)	33.7
Aortic valvuloplasty	39	1950	16.2
Endovascular thoraco-abdominal aneurism repaire	76-119	3800-5950	31.6-49.5
64-slice coronary CT	15 (3-32)	750 (150-1600)	6.3
Coronary calcium CT	3 (1-12)	150 (50-600)	1.2
Sestamibi stress test (1 day)	9	450	3.7

**Keywords** Interventional cardiology • Risk • Radiological protection • Radiation • Imaging

## Literature

1. Picano E, Eliseo V, Rehni MM, et al. The appropriate and justified use of medical radiation in cardiovascular imaging: a position document of the ESC Associations of Cardiovascular Imaging, Percutaneous Cardiovascular Interventions and Electrophysiology. *Eur Heart J.* 2014;35(10):665-72.
2. Russo GL, Tedesco I, Russo M, Cioppa A, Andreassi MG, Picano E. Cellular adaptive response to chronic radiation exposure in interventional cardiologists. *Eur Heart J.* 2012;33:408-14.
3. Vano E. Reduction of exposure of patients and staff to radiation during fluoroscopically guided interventional procedures. *Curr Radiol Rep.* 2013;1:11-22.
4. Brnić Z, Krpan T, Faj D, et al. Patient radiation doses in the most common interventional cardiology procedures in Croatia: first results. *Radiat Prot Dosimetry.* 2010;138(2):180-6.