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Editorial

New french diagnostic reference levels: Let's take stock of our daily practices!

Radiation protection aims to prevent or reduce health risks related to ionizing radiation, based on three main principles: justification, optimization, and limitation of radiation doses.

Diagnostic reference levels (DRLs) are a tool for optimization. They should not be considered as dose limits nor as optimal doses, because they can be exceeded for clinical needs. DRLs are dosimetric indicators of the quality of practices designed to identify situations requiring corrective action. The new DRL regulation decision No. 2019-DC-0667 of the Nuclear Safety Authority has been approved and transferred as a decree on the French law on 23 May 2019, applicable as of the 1st of July 2019 [1]. Compared to its last version of 2011, this new law has introduced DRLs for interventional radiology and nuclear medicine.

For example: cerebral catheter angiography (3 axis or more): dose-area product (DAP) 105 Gy.cm^2 and 13 min of fluoroscopy; cerebral aneurysm embolization: 190 Gy.cm^2 and 58 min; brain AVM embolization: 285 Gy.cm^2 and 68 min; vertebroplasty 80 Gy.cm^2 and 9 min. We may note that these doses were already respected in 2004 using image intensifier [2], and that the use of flat detector technology with 2k imaging resolution has heightened the image resolution without increasing the patient dose. These referrals in Interventional Neuroradiology have been awaited for several years, and there is still work to be done in this area: in particular for some more recent procedures that are not listed, such as mechanical thrombectomy. For this, it is necessary to master and optimize the exposure to limit deterministic adverse effects. The DACS (dosimetry archiving and communication system) could be a way to better evaluate and control the dose to the skin. The coordination of the medical, radiophysicists and industrial teams may lead to some design for this system that fits into the overall working environment of the radiologist. This would enable proper management of repeated therapeutic sessions as in the case of embolization of a cerebral arteriovenous malformation.

Adult cerebral CT-Scan DRL dropped from Volume Computed Tomography Dose Index (CTDIvol): 65 mGy/dose length-product (DLP): 1050 mGy.cm to 46 mGy/850 mGy.cm. It has been reported that CT protocols and radiation doses vary across countries but are primarily attributable to local choices regarding technical parameters, rather than patient characteristics, institutions, or machine specifications [3]. With the increase in the number of exams, as well as the rise in the use of some types of advanced imaging methods such as cerebral CT perfusion, our community should not neglect the impact of new technologies on dose reduction in CT or DSA, and their routine implementation [4]. The implementation of new advances in acquisition and reconstructions techniques [5] should be evaluated considering their impact on the reading and routine exposure [6], particularly with increase of wide-detector CT [7] and dual-source CT machines [8]. After exposure modulation and statistical-based iterative reconstruction, model-based iterative reconstructions are now more available and offer a great opportunity to reduce x-ray exposure while improving image quality at the same time [9]. Recently, spectral CT equipped with photon-counting detectors [10] and deep learning methods applied after [11] or during the reconstruction process [12] showed a high potential in noise reduction and therefore dose reduction. Image denoising using conventional neural networks can also be used in real-time in fluoroscopy [13,14] and could also allow dose reduction. This could be very interesting for potentially high-dose procedures. A dose reduction is possible in most cases, but must be done without lowering patient benefit [15]. As an example, Song et al. demonstrated that in a daily routine cerebral catheter angiography, a simple modification of the angle may help to minimize the radiation dose [16]. The last important origin of radiation for patients is related to nuclear medicine, which accounts for almost a quarter of the medical radiation burden in the USA [17]. In the new French DRLs some exams are still missing, e.g. ^{18}F-Dopa PET, ^{123}I-Ioflupane SPECT (DaTSCAN®), ^{18}F-fluoroethyltyrosine (FET) PET. As happens in radiology, reducing the dose to the patient in nuclear medicine will involve the use of artificial intelligence and new more sensitive detectors. With the publication of these new standards, it is time to review our practice, and when necessary, act accordingly!

Disclosure of interest

The authors declare that they have no competing interest.

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Julien Ognard [a,b]
David Bourhis [c]
René Anxionnat [d]
Douraied Ben Salem [a,b,*]

[a] Neuroradiology, University Hospital of Brest, boulevard Tanguy Prigent, 29609 Brest cedex, France
[b] Laboratory of medical information processing —LaTIM, INSERM UMR 1101, Université de Bretagne Occidentale, 22, avenue Camille Desmoulins, CS 93837, 29238 Brest cedex 3, France
[c] Medical Physics Unit, University Hospital of Brest, boulevard Tanguy Prigent, 29609 Brest cedex, France
[d] Neuroradiology, University Hospital of Nancy, 29, avenue du Maréchal de Lattre de Tassigny, 54035 Nancy, France

* Corresponding author at: Neuroradiology, University Hospital of Brest, boulevard Tanguy Prigent, 29609 Brest cedex, France.
E-mail address: douraied.bensalem@chu-brest.fr (D. Ben Salem)

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