RADIATION PROTECTION ASSESSMENT OF MEDICAL STAFF

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Abstract

The radiation protection of the medical staff is one of the main concerns in radiological protection and in particular for the application that could be characterized by a higher exposure, as interventional cardiology and radiology and nuclear medicine. In order to establish a common way of behaving the European Union promoted, within the 7th Framework Program, the ORAMED project (Optimization of RAdiation protection for MEDical staff) with the contribution of research institutions from Belgium, France, Germany, Italy, Poland, Spain, Slovakia and Switzerland and private industry. The present paper briefly describes the main aspects of this 3 years project. Through a campaign of measurement in hospitals and detailed numerical simulations, the project allowed collecting a large amount of data that made possible to prepare guidelines to be employed in the radiation protection optimization of the involved workers.

Keywords

Medical staff radiation protection, radiation protection optimization, Monte Carlo simulations

Introduction

In interventional radiology and cardiology procedures the medical staff is likely to receive significant radiation doses to their hands and parts of their body not covered with protective equipment (as legs and forearms) because physicians work close to X-ray field.

In nuclear medicine practices the dose to the hands is the main issue, especially when unsealed sources are used.

Indeed, the recent evidences of cataracts at lower doses [1] pointed out the lack of an optimized dose assessment for such organs for the personnel.

All these aspects required an effort to ameliorate the working condition of the physicians and technicians employed in this medical field in order to possibly reduce the radiation doses to which potentially they could be exposed to.

The ORAMED project (http://www.oramed-fp7.eu) started in the beginning of 2008 and run for 3 years was devoted to radiation protection of the medical staff employed in such applications. It was based on measurement campaigns, in various European hospitals, and series of numerical simulations representing the most recurrent workplaces/procedures. That allowed to identify and quantify the main parameters influencing the radiation exposures to the medical staff and to determine the possible actions to be performed in order to reduce the associated radiation doses.

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Materials and Methods

The project was structured in work packages: WP-1, interventional radiology and cardiology; WP-2, eye-lens dosimetry; WP-3, active personal dosemeters employment; WP-4, nuclear medicine; WP-5 dissemination of the results.

In WP1, WP2 and WP4 the measurements were accompanied with detailed numerical simulations with the aim of determining the parameters affecting the dose to the medical staff that could not be estimated through measurements or that could be hidden by other different effects.

For the WP1, in figure 1 is depicted: A) a numerical model employed to simulate the irradiation scenario encountered in interventional radiology and cardiology; B) one of the members of the medical staff equipped with the dosemeters at wrists and hands to detect extremity doses during the radiological practice; C) the investigated scenario.

Fig. 1 - Some images from WP1 (see the text for a detailed description)

For the WP2, in figure 2 is illustrated: A) the prototype of the developed dosemeter capable to estimate the doses to the eye-lenses; B) the plot reporting the percentage of usage of the protective equipments in interventional radiology; C) a picture of the test performed in the metrological laboratories on the dosemeter prototype.
For the WP3, in figure 3 is shown: A) the active personal dosimeters tested in laboratory, in metrological condition; B) a physician equipped with passive (TLD) and active dosimeters to be tested during routine practice; C) an image of the tests performed in the hospitals.

For the WP4, in figure 4 is reported: A) a picture showing the radiopharmaceuticals administration to the patient; B) a couple of the numerical models employed for the simulations; C) one of the plastic model employed in the experiment; D) a picture showing the preparation of the radionuclides.
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Fig. 4 - Some images from WP4 (see the text for a detailed description)

Results
The results were presented during the international workshop of Barcelona (Spain), in January 2011, and are available on the web site in pdf format (http://www.oramed-fp7.eu). A part for a lot of technical information, data, measurements results and Monte Carlo simulations it is important to emphasize that, in many cases, an important improvement to radiation protection of the medical staff can be obtained simply changing the habits of the workers and following better practices.
In interventional radiology and cardiology that means correctly uses the protective equipments and prefer the tube configuration that minimizes the scatter of the radiation from the patient.
In nuclear medicine a proper choice and usage of the available shielding for the vials and syringe and a proper employment of all the equipment that increases the distances from the sources are encouraged.
In general, it is mandatory an appropriate training of the personnel on the practice to be followed and on the importance of the correct placement of the dosemeter for an optimized monitoring of the radiation doses.

Conclusions
The research leading to these results has received funding from the European Atomic Energy Community's Seventh Framework Programme (FP7/2007-2011) under grant agreement n° 21136.
All the results will be published in a final document issued by EURADOS (www.eurados.org). The Barcelona workshop proceedings are in press on Radiation Measurements (Elsevier) and are already available on the journal web site. Some previous published paper presented the main aspects of the project and selected preliminary results [2-6].
References


