

TRAINING IN RADIATION PROTECTION FOR INTERVENTIONAL RADIOLOGY

E. Vañó (eliseov@med.ucm.es) and E. Guibelalde (egc@med.ucm.es)

Radiology Department and Medical Physics Service

Complutense University. San Carlos Hospital. 28040 Madrid. Spain.

1. ABSTRACT

Several potential problems have been detected in the safety aspects for the practice of interventional radiology procedures: a) An important increase in the number cases and their complexity and the corresponding increase of installations and specialists involved; b) New X ray systems more sophisticated, with advanced operational possibilities, requiring special skills in the operators to obtain the expected benefits; c) New medical specialists arriving to the interventional arena to profit the benefits of the interventional techniques without previous experience in radiation protection.

For that reason, education and training is one of the basic areas in any optimisation programme in radiation protection (RP). The medical field and especially interventional radiology requires actions to promote and to profit the benefit of the new emerging technologies for training (Internet, electronic books, etc.).

The EC has recently sponsored the MARTIR programme (Multimedia and Audiovisual Radiation Protection Training in Interventional Radiology) with the production of two videos on basic aspects of RP and quality control and one interactive CD-ROM to allow tailored individual training programmes. Those educational tools are being distributed cost free in the main European languages. To go ahead with these actions, the EC has decided to promote during 2002, a forum with the main Medical European Societies involved in these interventional procedures.

2. INTRODUCTION

Interventional radiology uses fluoroscopy extensively to guide and document the procedures. This usually involves significant radiological risk for professionals and patients.

In 1994 the Food and Drug Administration in USA [1] sent out Alert Notices about “serious x-ray induced skin injuries to patients during fluoroscopically guided procedures”. In 1995, the British Institute of Radiology and the World Health Organization (WHO) [2, 3] promoted specific scientific meetings to address recommendations to improve safety during these procedures. The Council Directive 97/43/EURATOM on medical exposures highlighted these aspects in Europe [4] and consider interventional radiology (article 9) as a “special practice” involving high doses to the patient.

During 2000, the International Commission on Radiological Protection published its recommendations on this topic [5]. Also, the International Electrotechnical Commission issued a Standard on particular requirements for the safety of X-ray equipment for interventional procedures [6]. Further the European Commission published a guideline on education and training in radiation protection for medical exposures [7] containing specific recommendations for interventional radiology.

In addition, the International Atomic Energy Agency in its recent International Conference on Radiological Protection of Patients in Diagnostic and Interventional Radiology, Nuclear Medicine and Radiotherapy, held in Malaga in 2001, included this topic as a part of the future action plan [8]. The European Commission has also included this topic in its Fifth Research Framework Programme, as a part of the DIMOND III project [9]. Important efforts have been made in the USA as well as Europe to produce training material [10 - 13].

One of the key issues is education and training in RP (both initial and on-going). The WHO and the European Directive (in its article 7) specifically recommend this training in RP over and above that is required by general radiologists. The European Guideline [7] gives recommendations about the training time required (20-30 hours) and the accreditation process. Interventional practices imply additional risks: more complex procedures with more time near the patient with the X ray “on”, and the issue of deterministic effects to the patients. RP training of the specialists helps to minimise these risks.

New educational technologies (electronic books, Internet, etc) could help for this task assuming a proper use of this

kind of material.

3. PROBLEMS TO BE ADDRESSED BY SPECIFIC TRAINING PROGRAMMES

Several potential problems have been detected in the safety aspects for the practice of interventional radiology procedures: a) An important increase in the number cases and their complexity and the corresponding increase of installations and specialists involved; b) New X ray systems more sophisticated, with advanced operational possibilities (e.g. rotational angiography, stepping acquisition, etc), requiring special skills in the operators to obtain the expected benefits; c) New medical specialists arriving to the interventional arena to profit the benefits of the interventional techniques (e.g. vascular surgeons) without previous experience in radiation protection.

The first two points should be solved with continuous training. The third one is more critical due that some groups of medical specialists starting very recently with interventional procedures have not been previously trained in basic radiation physics neither basic radiation protection. The European Guidelines [7] recommends for these specialists a training of 20-30 hours in radiation protection. In these cases, training is not the only problem. Sometimes X ray systems not designed for interventional procedures, are used in surgical theatres for complex procedures increasing the radiological risks for staff and for patients.

Until now, the experience in training programmes for these groups of specialists is scarce. One of the reasons could be that their professional societies are not aware about the level of radiological risk involved for professionals and patients.

Sometimes two different accreditations in RP are required

Other important problem in some countries is the lack of agreement between the regulatory and the health authorities to accept a common training programme in radiation protection including aspects of staff and public protection (usually under the competence of the regulatory authority) and aspects concerning the protection of the patients (usually under the responsibility of the health authority). This lack of agreement confuses the medical specialists and sometimes involves two different accreditations. In the future should be desirable a common programme including all the necessary aspects of radiation protection to guarantee a high level of safety for public, staff and patients.

No clear border between RP of staff and RD of patients

An important point to be taken into account is that in some medical procedures with ionising radiation it does not exist a clear border between the protection of the patient and the protection of the staff. Sometimes, a good protection of the patient involves a higher level of risk for the staff (e.g. to avoid the use of leaded gloves to manipulate with precision a catheter or to avoid the use of the protective screen during some parts of the procedure to go faster and to avoid an extra irradiation of the patient). In these cases, an integrated training of the radiation protection principles (staff and patients) should be advisable.

RP training and accreditation of fellows and residents

Finally, other critical problem is the RP training and accreditation of fellows and residents. Interventional radiology and interventional cardiology are usually medical supra-specialities. An important number of residents work during some months in interventional laboratories without a specific training in RP for his/her specialization. In addition, some foreign fellows spend short stages of some months in interventional labs conducting procedures without the local RP accreditation. The supervision of a senior staff could be not enough. To help in the solution of this problem, the Complutense University of Madrid and the European Commission have sponsored the MARTIR programme to produce an interactive CD-ROM that permits following a PC a training course with the possibility to do the corresponding examination and obtain directly from the PC the certification with the obtained score [13]. This is not a substitute of a real training course but can help to solve the initial problem of training for fellows and residents until they have the possibility to follow a regular course.

4. EUROPEAN ACTIONS

The EC has recently sponsored the MARTIR programme (Multimedia and Audiovisual Radiation Protection Training in Interventional Radiology) with the production of two videos on basic aspects of RP and quality control and one interactive CD-ROM to allow tailored individual training programmes that will be distributed cost free in the main European languages.



MARTIR CD)

The CD-ROM allows: a) To select different levels of training (radiologists, cardiologists, medical physicists, radiographers, etc); b) To follow a training programme as a regular course (step by step) or looking only for the topics of interest; c) To do some auto evaluation multiple choice questions at the end of the different sections or topics; d) To perform a final examination at the end of the course and to have a certification with the total time dedicated to the training programme with the computer and the score obtained with the final examination. An individual accreditation certificate can be printed with all these information. This process is done by means of encrypted files (only visible with a protected program also included in

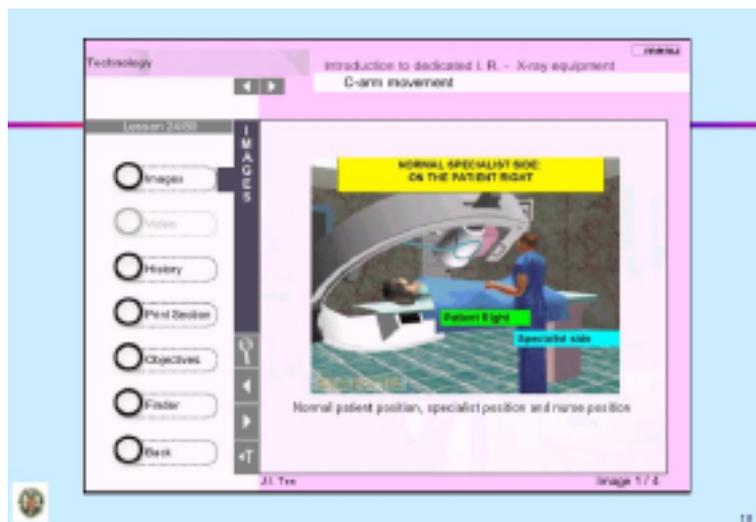
The CD-ROM can also be used as a bibliographic manual to review the knowledge in radiation protection. It contains 80 lessons with their texts, 350 images, 30 videos, 25 power point slide presentations and a good collection of references and links updated for the year 2001. This material is not protected so that people can use it freely, assuming a proper use of EC copyright and referring the source. An interactive glossary with most common radiation protection terms is also included. A non-readable database with three hundred 5-true/false multiple-choice questions, sorted in different levels of difficulty is used for the program to computing the individual accreditation exam.

To go ahead with these actions, the EC has decided to promote during 2002, a forum with the main Medical European Societies involved in these interventional procedures: Cardiovascular and Interventional Radiological Society of Europe, CIRSE; European Society of Vascular Surgery, ESVS; European Society of Cardiology, ESC.

5. SOME PREVIOUS EXPERIENCES WITH THE MARTIR CD-ROM

During 2001 and 2002 the MARTIR material have been distributed for evaluation purposes to different experts and it has been used in different pilot courses.

- Comments received from the European experts. About 40 different experts including radiologists, cardiologists, surgeons, vascular, neuroradiologists, medical physicists, technicians, manufacturers and members of regulation boards received copies of the CD at the development stage so that their valuable comments and improvements were included when possible. Most experts consider that the CD media is a good tool that allows a wider and cheaper distribution that other conventional courses. Thus a



common basic training could be more easily achieve by specialists in different countries and with different background knowledge. In this sense, it is the intention of the University Complutense of Madrid to convert in future the video courses also to CD media. CD has also the possibility of being easily upgraded or updated with new information or new accreditation exams.

- Students of the School of Medicine. The University Complutense of Madrid offers an optional subject on

Radiation Protection for the students of Medicine during their 4th or 5th year. About 100 hundred students follow this topic per year. 10% of these students follow the MARTIR CD at home as a pilot course. All of them used the CD at least during 40 hours, completed the low level step-by-step course and pass the exam (score over 75% for 60 multiple choice questions). The student had the opportunity of improving the qualification as many times as they wish by repeating the electronic exam. 87% of the students after finishing the course stated that this education methodology was very suitable for them.

- Pilot Course of the SERVEI. A pilot course of the Spanish Society of Vascular Radiology and Interventionist hold in Madrid last summer offered the opportunity to show MARTIR CD to 25 vascular specialists. All of them agree in terms of the suitability of this course, especially for non-senior specialists.

6. CONCLUSIONS

An effort must be done to encourage interventionalists to follow training courses in Radiation Protection, particularly when basic courses of RP are not included in their curricula. MARTIR CD offers solutions to complement conventional Radiation Protection courses, e.g., for countries where no official accreditation is required, for training of fellows working in interventional labs while waiting for a regular course, for educational material for lecturers in regular courses, for continuous training programs, etc.

7. REFERENCES

1. U.S. Food & Drug Administration (FDA). Avoidance of serious x-ray induced skin injuries to patients during fluoroscopically guided procedures. *Med Bull* 1994; 24(2): 7-17.
2. Bäumel A, Bauer B, Bernhardt JH, Stieve FE, Veit R, Zeitlberger I, editors. Efficacy and Radiation Safety in Interventional Radiology: BfS ISH 178/97. Proceedings of the 1995 Joint WHO/ISH Workshop on Efficacy and Radiation Safety in Interventional Radiology; October 9-13; Munich-Neuherberg. Salzgitter, Germany: Bundesamt für Strahlenschutz, 1997. Also: Efficacy and Radiation Safety in Interventional Radiology. WHO 2000. Geneva.
3. Radiation Protection in Interventional Radiology. Proceedings of a BIR-CEC meeting held on 6 December 1993. Edited by K. Faulkner and D. Teunen. Published by the British Institute of Radiology. London, 1995.
4. European Union 1997. Council Directive 97/43 Euratom, on health protection of individuals against the dangers of ionizing radiation in relation to medical exposure, and repealing Directive 84/466 Euratom. *Official Journal of the European Communities* No L 180, 9th July 1997, 22-27.
5. ICRP Publication 85. Avoidance of radiation injuries from medical interventional procedures. *Ann ICRP* 2000;30(2). Pergamon. Elsevier Science Ltd. Oxford. UK.
6. Medical electrical equipment. Part 2-43: Particular requirements for the safety of X-ray equipment for interventional procedures. IEC 60601-2-43. First edition 2000-06. International Electrotechnical Commission. Geneva. Switzerland.
7. Guidelines on education and training in radiation protection for medical exposures. Radiation Protection 116, European Commission. Directorate General Environment, Nuclear Safety and Civil Protection. Luxembourg, 2000). Available at <http://europa.eu.int/comm/environment/radprot> . Last access 7 July 2002.
8. International Conference on Radiological Protection of Patients in Diagnostic and Interventional Radiology, Nuclear Medicine and Radiotherapy. Malaga, 26-30 March 2001. IAEA-CN-85-196 and IAEA-CSP-7/CD. 2001.
9. DIMOND. Measures for optimising radiological information and dose in digital imaging and interventional radiology. European Commission. Fifth Framework Programme. 1998-2002. Programme Acronym: FP5-EAECTP C. Project Reference: FIGM-2000-00061. Project Acronym: DIMOND III. http://dbs.cordis.lu/fep/FP5/FP5_PROJL_search.html. Last access 29 July 2002.
10. Wagner LK and Archer BR. Minimising risks from fluoroscopic x rays. Third Edition. Partners in Radiation Management (R.M. Partnership). The Woodlands, TX 77381. USA 2000.
11. Balter S. Interventional fluoroscopy. Physics, technology and safety. Wiley-Liss, New York, 2001.

12. Balter S, Editor. Physical and Technical Aspects of Angiography and Interventional Radiology. A Categorical Course in Physics. Annual Meeting of the Radiological Society of North America. Chicago. RSNA, 1995.

13. MARTIR (Multimedia and Audiovisual Radiation Protection Training in Interventional Radiology). CD-ROM. Radiation Protection 119, European Commission. Directorate General Environment, Nuclear Safety and Civil Protection. Luxembourg, 2002 (free available).