Training in radiological protection for interventional cardiologists. Initial European experience.

Vano E (1), Back C (2), Beissel J (3), Bernardi G (4) , Padovani G (5)

(1) Medical Physics Service. San Carlos University Hospital. Complutense University. 28040 Madrid. Spain. <eliseov@med.ucm.es>
(2) Radiation Protection Division. Ministry of Health. Luxembourg. <Carlo.Back@ms.etat.lu>
(3) National Institute of Cardiac Surgery and Interventional Cardiology. Luxembourg. <beissel.jean@chl.lu>
(4) Interventional Cardiology Service. Ospedale S. Maria della Misericordia. Udine. Italy. <guglbern@tin.it>
(5) Medical Physics Service. Ospedale S. Maria della Misericordia. Udine. Italy. <padovani.renato@aoud.sanita.fvg.it>

Abstract

One of the first European experiences to train interventional cardiologists (IC) in radiological protection (RP) to fulfil the requirements of the Medical Exposures Directive is described. A pilot course was taught by an international panel of lecturers at the National Institute of Cardiac Surgery and Interventional Cardiology in Luxembourg following the educational objectives recommended by the European Guidelines RP-116. Senior cardiologists attended the course of two full days (16 hours of training). Practical sessions with the X ray systems installed in the Institute hosting the course were also included. Twenty people attended the course (IC, medical physicists and radiographers). The nine IC who follow regularly the course and had attended the exam, had passed it. A survey was carried out at the end of the training in order to improve the programme. The main results were the following: The course length (short/suitable/long) was considered suitable by 60% of delegates. A 40% believed the course long. The mean course score (maximum of 10 points) was 8.3. The mean lecturer score (maximum of 10 points) was 8.0. The subjects related with “biological effects” and “optimization” should have further emphasis in future versions of the course.

Introduction

Interventional cardiology uses fluoroscopy extensively for guiding and cineangiography to document the procedures involving a certain radiological risk for professionals and patients. Radiological protection (RP) is an important issue during the design of the laboratories (X ray rooms), the purchase of the imaging equipment, the routine practice of the speciality and during the training of the operators.

Wilde and co-workers stresses in a editorial published in Heart in 2001 [1] the radiation hazards for the patient in cardiac highlighting that radiation dose to both patient and staff in IC is high compared to diagnostic procedures. The authors also quote that the UK legislation requires that individuals who took the responsibility of the medical exposure must be properly trained in radiation protection. Similar requirements exist in other Member States of the European Union but the process to offer specific training and to give the accreditation of that knowledge is still lacking in some countries. Vano, also in the Hearth journal, published recently an invited Editorial [2] about the radiation exposure to cardiologists and how important is the RP training to reduce it.
Several national and international publications have addressed the topic of radiation safety in interventional procedures. In 1994 the Food and Drug Administration in USA [3] sent out alert notices regarding “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) [4, 5] promoted specific scientific meetings to address recommendations to improve safety during such procedures. The Council Directive 97/43/EURATOM on medical exposures highlighted these aspects in Europe [6] and consider interventional procedures (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 [7]. Also, the International Electrotechnical Commission issued a Standard on particular requirements for the safety of X-ray equipment for interventional procedures [8]. Furthermore, the European Commission published a guideline on education and training in radiation protection for medical exposures [9] containing specific recommendations for interventional practices guided by fluoroscopy.

In addition, the International Atomic Energy Agency after the 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 approved action plan [10]. The European Commission has also included this topic in its Fifth Research Framework Programme, as a part of the DIMOND III project [11] (DIMOND = Digital Imaging: Measures for Optimising Radiological Information Content and Dose). Important efforts have been made in the USA as well as Europe to produce training material [11 - 15].

One of the key issues is education and training in RP (both initial and on-going). The WHO, the ICRP and the European Directive (in its article 7) specifically recommend this training in RP. The European Guideline [9] gives recommendations about the training time in radiological protection required (20-30 hours) for IC specialists and the accreditation process. Interventional practices entail additional risks due to more complex procedures with more operator time near the patient during fluoroscopy screening, and the possibility to induce deterministic effects to the patient (skin injuries). RP training of the specialists helps to minimise these risks.

The issue of radiation protection does not seem to receive much attention by interventional cardiologists. This topic is often omitted at meetings, congresses and live-courses for IC. Sometimes, cardiologists also forget to inform patients about radiation risks.

There is also the possibility that, in some Countries, courses on radiation protection are held in a formal way only, to comply with the law, instead of giving the audience valuable information.

**Course planning**

In Luxembourg, the national legislation requires this specific training in RP and the National Institute of Cardiac Surgery and Interventional Cardiology in cooperation with the Radiation Protection Division of the Ministry of Health decided to organise a pilot course to implement training in the Country and to give the corresponding accreditation in radiological protection to the specialists following the training and passing the exam. For that task, and considering the previous experience in similar training activities and accreditation for interventional radiology, and the cooperation existing as part of the European research programmes, the Spanish Ministry of Health and the San Carlos University Hospital of Madrid were contacted in order to profit of their experience. The cooperation of the Italian Udine Hospital (Medical Physics and Interventional Cardiology Services) and Siemens was also foreseen.

After some previous meetings between the experts of Luxembourg and Madrid to plan the course programme, it was agreed to reduce the recommended time of training in the European
Guideline (20-30 hours) [9] to a full two days course (16 hours) considering the previous experience and knowledge of the senior interventional cardiologists involved in the course.

The programme included the main topics recommended by the European Guidelines: X ray systems for interventional cardiology, biological effects of radiation, radiation protection of the patient and staff, procedure optimisation and image quality evaluation, quality assurance programmes and standards and regulations. In addition practical sessions with the X ray systems installed in the Institute hosting the course were organised. Measures of patient and staff doses for the different fluoroscopy and cine acquisition modes were done. Differences in image quality and dose values were highlighted during these practical.

Several discussion sessions were included along the course. These sessions were chaired by senior medical physicists and interventional cardiologists experienced in optimisation programmes in cardiology laboratories. A final examination (comprising of a set of 20 multiple choice questions with 5 answers (allowing to evaluate 100 specific learning objectives) was also included. Achievement of a set minimum score was a condition of accreditation.

During the course preparation, some meetings and contacts between the lecturers allowed to optimise the content of the different lectures and to avoid excessive overlapping of subject matter. Unfortunately the participation of lecturers from 4 different European Countries made this a difficult task and the coordination should be improved in future similar activities. Also, practical sessions were previously prepared with the help of Siemens engineers in order to have a complete characterisation of the X ray systems used during the Course.

The Health Authority (the Ministry of Health from Luxembourg) gave the accreditation to the course and signed the diplomas of the specialists who have passed the examination.

The course was held between the 13th and 14th of December, 2002, at the National Institute of Cardiac Surgery and Interventional Cardiology in Luxembourg. Twenty people attended the course (interventional cardiologists, medical physicists, radiographers, etc). The nine interventional cardiologists, who follow regularly the course and had attended the exam, had passed it.

One of the sessions was given over to the use of the MARTIR CD-ROM (Multimedia and Audiovisual Radiation Protection Training in Interventional Radiology) [15].

Results

A survey was carried out at the end of the training in order to obtain information to improve the programme for future versions of the course. The results were the following:

- The course length (short/suitable/long) was considered suitable by 60% of delegates. A 40% believed the course long (some overlapping in the lectures was pointed out as the cause of that opinion).
- The typical course score (maximum of 10 points) was 8.3.
- The typical lecturer score (maximum of 10 points) was 8.0.
- The global score of the course syllabus (maximum of 10 points) was 7.6
- The global score for the practical sessions was 7.4.
- The documentation distributed to the delegates, consisted of a hard copy of the slides presented in the lectures. This was considered sufficient by all of delegates.
- The subjects related with “biological effects” and “optimization” are to be given further emphasis in future versions of the course.
- The usefulness of the MARTIR project CD-ROM was positively received by 100% of the attendants.
Conclusions

In conclusion, the group of senior cardiologists attending the course, considered the effort worthwhile and benefit was derived. The European Guideline [9] states that “A system for credentialing RP training programmes should be established at national or regional level. This process should be undertaken by the Regulatory Authority, with the help of Academic Institutions (Universities) and scientific or professional societies”. It is to be hoped that other Member States have similar experiences in their attempt to implement the European guideline on education and training in radiation protection for interventional cardiology.

Acknowledgements

This pilot course profited from the experience of the DIMOND European Programme partially funded under the European Commission 5th Framework Programme (1998-2002), Nuclear Fission and Radiation Protection Contract DIMOND III, Nuclear FIGM-CT-2000-00061. Authors want to thank Siemens for the support during the characterisation of the X ray systems and the practical sessions. Also thank the Spanish Ministry of Health, the San Carlos University Hospital in Madrid and the Spanish Society of Vascular and Interventional Radiology for the transfer of the full dossier of a previous similar pilot course held in Spain.

References

10. International Conference on Radiological Protection of Patients in Diagnostic and Interventional Radiology, Nuclear Medicine and Radiotherapy. Malaga, 26-30 March


