RADIOLOGICAL PROTECTION IN INTERVENTIONAL CARDIOLOGY IN CHILE

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Abstract

In September 2000, an expert mission was assigned to Chile, under the regional project named "International BBS in Medical Practices Radiation Protection and Quality Assurance In Interventional Radiology" (ARCAL XLIX). The objectives of the mission were to evaluate the level of radiation protection (RP) and safety in interventional cardiology (IC) installations.

A team of local cardiologists, medical physicists and technologists was created for this purpose and during one week, several cardiology laboratories were evaluated and some basic quality controls (QC) were carried out. A basic pilot training course in radiation protection was imparted at the Hospital of the University of Chile in Santiago de Chile and some of the key objectives for a future national quality assurance programme were presented during the national congress of IC. In addition, a national survey on radiation protection aspects was circulated and its results evaluated. These activities enabled the local team to become familiar with the methodology of assessment of the level of protection and the organization of a programme, which was illustrated with the examples of similar European programmes.

As result of these actions, several proposals were made to both the local authorities and the IAEA. The most important were: a) to initiate a basic QC programme, b) to organize a training in RP for cardiologists in order to formalize their accreditation, c) to improve personal occupational dosimetry, d) to initiate a programme of patient dosimetry, e) to optimize the technical and clinical protocols, f) to create a national registry of incidents with skin injuries.

1. Introduction

In Chile there are 48 specialists in interventional cardiology (IC) training in renowned European and North American centers. They perform nearly 1,500 therapeutic and 6,000 diagnostic procedures in a year. Facilities and procedures for cardiac electro-physiology are not included in these figures. For comparison, in Spain (data from 1999), there are 110 hemo-dynamic rooms (in 83 hospitals) where 575 therapeutic procedures (22% of the total) per million of population are performed and 2,070 diagnostic procedures per million of population (78% of the total) [1]. These numbers are 50% of the procedures in other European countries, such as Austria, Switzerland and Germany [2].

Considering the rate of development in Chile, it can be assumed that in a medium term it will reach the current levels of Spain.

There is no specific programme for training cardiologists in radiation protection. There are, however, protective elements in most of the facilities, such as couch-supported articulated shielded screens and personal shielded garment (aprons and thyroid shielding). Personal monitoring does not seem to be used systematically and the dosemeter reading are made by institutions not dependent on the "Comisión Chilena de Energía Nuclear" and with unknown quality control and no systematic participation in intercomparative round. Personal exposure monitoring is done using one single dosimeter which may be insufficient for IC. [3].
With regard to the RP of patients, there is neither a general culture and awareness of cardiologist nor of suppliers of x-ray equipment. The current organization of the IC is structured around the Chilean Society of Cardiology and Cardiovascular Surgery. The interest by its members in achieving a qualitative and quantitative change towards a culture of patient protection and towards implementation of a QA programme in a short time, provides ideal conditions for moving in this direction.

2. Material and methods

In September 2000, an expert mission was assigned to Chile, under the regional project named "International BBS in Medical Practices Radiation Protection and Quality Assurance In Interventional Radiology" (ARCAL XLIX). The objectives of the mission were to evaluate the level of RP and safety in IC. In addition a basic training action in RP and a pilot QA programme should be initiated.

A team of local cardiologists, medical physicists and technologists was created for this purpose and during one week, several cardiology laboratories were evaluated and some basic QC were carried out. A basic pilot training course in RP was imparted at the Hospital of the University in Santiago de Chile and some of the key objectives for a future national quality assurance programme were presented during the national congress of IC. In addition, a national trial on RP aspects was circulated and its results evaluated.

Previous contact with the local delegations of the main industry supplying X-ray systems in Chile (Philips, General Electric, Siemens and Toshiba) was established in order to obtain support for these evaluations.

The basic QC carried out, during the mission, in several installations was a reduced version of the European DIMOND (Digital Imaging: Measures for Optimizing Radiological Information Content and Dose) protocol [4]. In addition, the maximum patient entrance dose rate and the image quality obtained with a test object (TOR 18-FG, from the Leeds University) was measured. In the cardiology lab of the Hospital Clinico of the University of Chile, some patient doses were measured with a transmission chamber together with skin dose evaluation using slow radiotherapy films [5].

A basic pilot training course in RP was imparted at the Hospital of the Chile University in Santiago and during the National Congress of IC held in Antofagasta.

A national survey on radiation protection and collateral aspects was prepared similar to one used in Spain by the Spanish Section of IC to be answered by the medical specialists in Chile.

3. Results

Survey
A survey on RP aspects was made on a personal and anonymous basis. It was distributed to 16 of the 19 existing centers in the country and reply was obtained from 13 of them. Of the 46 professionals involved in IC 39 responded, which gives the survey a valuable indicator of the activity at national level. 56% of those polled consider that their knowledge of RP are adequate for their professional activity, however 97% considers appropriate to perform
continuous training in radiation protection as well as in QC in order to optimize the use of their equipment.

**Equipment**

Equipment in Chile is uneven. Three of units are of a design of the 1977, 1979 and 1986 all of them had to be adapted for IC. 71% of the equipment used in Chile includes digital image acquisition. 53% of those polled in the survey consider that their facilities are adequate and 38% consider that they should be renewed as RP is concerned. Half of those polled feel acquainted with the features and capabilities of their equipment, while the other half mean to have incomplete knowledge of the use of the equipment; 80% would like to have more detailed information on the capabilities of the equipment.

**Occupational dose assessment**

Dose monitoring is available to 67 % of the interventional cardiologists but only 61% of those polled use it on a regular basis and 33% lack dosimetric control. In none of the centers are TLD dosimeters available. 54% of the cardiologists are aware of their occupational dose values and pay attention to them and 33% are not aware of them. However, 92% indicate that no professional advice is available on radiological protection; this advice is wanted by 90% of those polled and all participants in the survey consider that effort and investments should be made to improve the level of protection to the professionals involved in IC. The average team for an IC unit in Chile consists of four interventionists, two to three nurses, one to two technologist, two to four nursing assistants. There is only one center with a medical physicist. 92% of those polled declare to have quality control and maintenance for the equipment, and 48% of them indicate that this is performed on scheduled basis. 61% report to be aware of the results of maintenance activities.

**Patient dose assessment**

All participants in the survey consider that patient dose assessment is of prime importance and 97% agree to participate in comparative studies with other countries, although when interrogated about a possibly excessive exposure, 84% declare that this never occurred and 90% state that never know about of any skin injuries related to the area of incidence of the radiation beam on patients who underwent IC procedure.

4. **Conclusions**

1. Interventional cardiology in Chile is well organized and a programme of QC and RP could be easily implemented. Cardiologists performing interventional procedures show a great interest in radiation protection and demand a training programme in order to achieve the necessary knowledge to adequately protect their patients and to obtain an accreditation in radiation protection from the Chilean health authority.
2. A pilot training course in radiation protection has been designed for interventional cardiologists (20-30 hours following the European approach on protection in medical exposure).
3. Occupational protection conditions are in general adequate but personal monitoring should be improved by recommending the use of two TLD dosimeters by professionals with a significant workload in IC.
4. Equipment assessed is in good condition in general although there is not yet a culture of radiation protection of patient, which must be implemented in a near future.
5. It is advisable to initiate a programme of patient dose monitoring, to optimize the technical and clinical protocols and to initiate a national registry of incidents with skin injuries.

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References