Report on the Pilot Survey on Obtaining Occupational Exposure Data in Interventional Cardiology

Executive Summary

As part of the Information System on Occupational Exposure in Medicine, Industry and Research (ISEMIR) project, the Working Group on occupational exposures and radiation protection of staff in interventional cardiology (WGIC) was formed in 2009 to undertake activities focussed on improving the implementation of occupational radiation protection in interventional cardiology (IC).

In 2009 the WGIC conducted a world-wide survey to gain insight into the practice of occupational radiation protection in IC around the world. Conclusions from the 2009 survey included that there was room for significant improvement in the practice of occupational radiation protection throughout the world, and that obtaining reliable data from radiation protection regulatory bodies on occupational exposures in IC was difficult.

This resulted in a pilot survey in 2010-11 to test the feasibility of obtaining IC occupational dose data directly from IC facilities and to test whether the reported data could be used to derive a dose metric for occupational exposure in IC that could, in a later situation, be used to assess the effectiveness of actions to improve the optimization of occupational radiation protection in a given IC facility.

About 100 selected IC facilities from around the world were contacted and responses were received from 26 IC facilities, with about 850 individuals including interventional cardiologists (347), electrophysiologists (49), nurses (210) and technicians (126).

The majority of responding IC facilities had monthly occupational exposure monitoring periods. For IC physicians, two dosimeters were worn in 27% of facilities, one under apron dosimeter in 50% of facilities, and one over apron dosimeter in 19% of facilities. For non-physician personnel, the respective percentages were: 15%, 38%, and 23%. Numbers and positions of dosimeters worn were not reported for physicians in 4% of IC facilities and for non-physician personnel in 23% of facilities.

Many of the reported dose data were of poor quality. Reported “zero doses” for physicians per monitoring period were common (55% for under apron dosimeters and 33% for over apron dosimeters), and there were missing data (16%). About 10% of physicians with over apron dosimeters reported zero doses for all their monitoring periods in the year and, similarly, about one-quarter of physicians with under apron dosimeters reported zero doses for the entire year. Compliance with being monitored continues to be an issue with many IC personnel.

Dose metrics (occupational dose per procedure) were derived from the survey data, including reported zero doses. For physicians, the mean occupational effective dose per procedure was about 10 µSv for interventional cardiologists and about 3 µSv for electrophysiologists. The dose metric for trainee interventional cardiologists appeared to be higher than for qualified interventional cardiologists. Both nurses and

technicians had a mean occupational effective dose per procedure of a little less than 1 μSv.

Three types of quality factor were derived to assess each individual's reported monitoring period dose data, based on: the compliance of an individual in being monitored; the percentage of reported "zero doses"; and the consistency of reported doses. By assigning a threshold value to a quality factor, suspect data were able to be excluded from the analysis. The application of such filtering increased the value of the dose metric relative to that derived from the raw data, primarily due to the removal of varying numbers of zero doses. The filtering was most successful for dose metrics based on over apron dosimeters, highlighting the limited usefulness of under apron dosimeters when the dose being detected is close to the limits of detectability.

The average dose metric of effective dose per procedure was derived for each IC facility for their qualified interventional cardiologists. Using the raw data, the facility-averaged dose metric (occupational effective dose per procedure) for qualified interventional cardiologists ranged from 0.9 to 75.8 μSv per procedure, with a mean and median of 9.6 and 3.9 μSv per procedure. Even if the variation due to procedure complexity is considered, this would seem to indicate a wide variation in occupational radiation protection practice between the different IC facilities and, further, points to how a larger set of data with more participating facilities and personnel could provide a very useful benchmarking tool as an aid to improving the optimization of occupational radiation protection.

The two WGIC surveys have set the stage for the development of the ISEMIR international database. The purpose of the ISEMIR database will be to provide an active tool for assessing the level of, and hence guiding, implementation of the radiation protection principle of optimization of protection at a given IC facility. Once fully developed and populated, the database will support three broad types of analyses – occupational doses per procedure as a function of personnel and facility attributes (i.e. the circumstances of the occupational exposure); benchmarking of facilities and individuals; and trends with time.

The second WGIC survey has shown that it is feasible to obtain data on occupational exposure in IC directly from IC facilities and to use this data to derive dose metrics for occupational exposure in IC. Because the participation rate was about 25%, it does emphasize that, if the proposed ISEMIR international database is to be successful, there needs to be a clear incentive for participation – in particular it needs to be demonstrable that the database would be a tool for each IC facility to use as an interactive means for improving occupational radiation protection in their facility. With regard to the dose metrics, this survey has shown that the quality of data needs to be improved – in particular, better compliance in wearing dosimeters is needed.