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Improving Radiation Safety Awareness Amongst Cardiologists & GPS

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Please tell us how you became interested in the study and promotion of radiation safety.

I am a cardiologist and a Senior Medical Researcher for the Italian National Research Council at the Institute of Clinical Physiology in Pisa. I am a clinical cardiologist with experience in the Intensive Care Unit (ICU), database and epidemiological studies. In the last ten years our institute and its present director, Dr. Eugenio Picano became pioneers in the development of new practice models to improve the economic, social and biological sustainability of medical imaging. These underlying principles were the basis for my interest in the field.

What is your opinion on the debate over who is responsible for errors in radiation safety; the department chair, policy-makers, or the individual technologist?

In my opinion the responsibility for errors in radiation safety lies at each level within an organisation. Policy makers have the power to influence or determine policies and practices and should take into account the problem of radiation safety. Doctors should know the level of radiation that their patients are exposed to during radiological investigations and should avoid inappropriate radiological prescriptions and should correctly inform patients about the procedure. Technologists should be aware of the mechanisms to evaluate appropriate dose level and to use the "as low as reasonably achievable" dose (the ALARA principle). Patients should be required to sign an explicit and transparent informed consent form for each radiological examination. This will make doctors and patients more likely to consider the risks as well as the benefits as well as helping to reduce pressure from patients for redundant examinations.

You have investigated the low awareness of radiation safety issues amongst cardiologists. Why are cardiologists an interesting target group for increased awareness in this particular area?

Cardiologists prescribe and/or directly perform >50 percent of all imaging examinations, accounting for about two thirds of the total effective dose to patients. Three types of procedures were responsible for about 86 percent of the total collective effective dose: arteriography and interventional catheterisations, nuclear cardiac procedures and CT. Moreover, as interventional cardiologists, they are the most at risk amongst exposed professionals (their professional exposure being three times higher than radiologists). Their knowledge of the doses and risks of ionising testing is low and this lack of awareness is true for all classes of doctors. These are the main reasons for the growing interest of the cardiology community towards the radiation issue.

Can you tell us about your work to improve this knowledge amongst cardiologists?

The study's hypothesis is that radioprotection unawareness can be modified with a brief, targeted teaching effort. The aim of the study was to assess radioprotection awareness of physicians (mainly cardiologists, but also general practitioners) before and after a one-day intensive radioprotection primer course, which consisted of six classroom lessons. Each attendee was asked to answer a multiple-choice test at entry and again at the end of the class. In each of the 403 attendees who completed the study, their radiological awareness score improved.

What were the conclusions of this research?

Awareness of radiological doses and risks, albeit essential for risk–benefit assessment of radiological testing, is limited among physicians. However, it can dramatically improve by means of a limited teaching effort through targeted training.

What should cardiologists do to protect their patients when prescribing imaging tests?

Cardiologists, as with any class of doctors, should prescribe only appropriate procedures following guideline indications. Moreover, when it is possible, I would suggest choosing a radiation free procedure (echography or magnetic resonance versus myocardial scintigraphy and CT) to minimise the radiation injury hazard to their patients.

Can you tell us about the SUIT-Heart (Stop Useless Imaging Testing in Heart disease) Project of the Tuscany reg ion?

The SUIT-Heart (Stop Useless Imaging Testing in Heart disease) project was funded by a grant of the Istituto Toscana Tumori (Tuscany Institute for Cancer), and co-funded by an unrestricted scientific grant of Banca Popolare del Cassinate for the economic sustainability of medical testing. The SUIT-HEART project started to reshape current clinical cardiological practice, with a paradigm shift based on expanding physician knowledge. The project is organised into six main thematic sub-projects targeting different objectives; these are in the clinical, radiological-radioprotection, economic, informatics, patients' rights and oncology areas. The result is expected to improve the quality of medical care, lower healthcare costs, and move a substantial step towards more sustainable application of medical imaging in contemporary medicine. The project was financed by the Regional Institute of Cancer. We believe that patients, doctors and our society will benefit from the project.

Can you tell us about Radio-Risk software, developed by yourself and colleagues with the aim of providing more user-friendly risk evaluation?

The purpose of this work was to develop user-friendly software for simpler estimation and communication of radiological risk to patients and doctors. The software programme allows estimation of cumulative radiation dose starting from a predetermined menu of variables relating to natural (e.g., airplane flights and geo-tracked background exposure), professional (e.g., cath lab workers) and medical (e.g., CT, cardiac scintigraphy, coronary stenting) sources.

What parameters does the software use in its evaluation of long-term cumulative risk in patients?

For each reference effective dose, cancer age- and genderweighted risks were derived from the BEIR VII Committee report of 2006.

What does current knowledge tell us about the percentage of patients who develop negative side effects from an excess of radiation from x-rays taken over a lifespan?

The risk estimates are based on studies from populations exposed to a range of doses, such as the Japanese atomic bomb survivors. The risk from diagnostic x-rays is invisible, longterm and cumulative. It is significantly modulated by polymorphisms of genes involved in DNA damage and repair such as the BRCA1/BRCA2 mutation. The target molecule is DNA, and target cells are actively dividing somatic cells for cancer effects, embryo cells for teratogenic effects and germ cells for adverse hereditary effects.

The updated risk estimates were released in the Seventh Report of the authorative Committee to Assess Health Risks from Exposure to Low Levels of Ionising Radiation (BEIR VII report), which provides a framework for estimating the lifetime attributable risk of cancer incidence from radiation exposure using the most current data on the health effects of radiation. A 64-slice CT coronary angiography without tube current modulation is associated with a cancer risk ranging from one in 143 for a 20-year-old woman to one in 5,017 in an 80-year-old man for a scan performed with tube current modulation. Females are at higher risk than males and children at higher risk than adults. According to these estimates it is predicted that for an adult, an effective dose of 100 mSv results in a risk of cancer of approximately of 1 out of 100 exposed patients. About 42 additional people in the same group would be expected to develop solid cancer or leukemia from other causes. Current risk estimates suffer from some degree of approximation and uncertainties – it can be two or three times higher, or lower, than current estimates.

In what ways did you make the Radio-Risk software solution accessible and user friendly?

The programme is fully downloadable at http://suitheart. ifc.cnr.it. The software uses simple graphic display (for cumulative temporal trends of exposure, cancer cases out of 100 exposed persons and risk equivalent).

Finally, what are your key pieces of advice to those prescribing and performing radiation involved exams?

Common sense, deontological code, patients' rights, medical imaging guidelines and Euratom law all recommend the justified, optimised, responsible and informed use of testing with ionising radiation. Many imaging technologies offer diagnostic benefits and should be prescribed if appropriate following the principle that each patient should get the right imaging exam, at the right time, with the right radiation dose.

A NOVEL TOOL FOR USER-FRIENDLY ESTIMATION OF NATURAL, DIAGNOSTIC AND PROFESSIONAL RADIATION RISK: RADIO-RISK SOFTWARE.

In 2010 the International Atomic Energy Agency launched the "3 A's campaign": Audit, Appropriateness and Awareness for radiological justification, which is an effective tool for cancer prevention. Cardiologists prescribe the majority of radiological testing, but their awareness of doses and risks of ionizing cardiac imaging test is low. To assess radioprotection awareness of prescribing and practicing physicians (mainly cardiologists) before and after a radioprotection course, organisers held a one-day six hour primer of radioprotection for a limited number (20 - 35) of physicians. Awareness of radiological doses and risks, albeit essential for risk-benefit assessment of radiological testing, is suboptimal among cardiologists, but can dramatically improve with a limited teaching effort through targeted training.

BACKGROUND:
Awareness of radiological risk is low among doctors and patients. An educational/decision tool that considers each patient's cumulative lifetime radiation exposure would facilitate provider-patient communication.

AIM:
The purpose of this work was to develop user-friendly software for simple estimation and communication of radiological risk to patients and doctors as a part of the SUIT-Heart (Stop Useless Imaging Testing in Heart disease) Project of the Tuscany Region.

METHODS:
The researchers developed a novel software programme (PC-platform, Windows OS fully downloadable at http://suitheart. ifc.cnr.it) considering reference dose estimates from American Heart Association Radiological Imaging 2009 guidelines and UK Royal College of Radiology 2007 guidelines. Cancer age and gender-weighted risk were derived from Biological Effects of Ionising Radiation VII Committee, 2006.

RESULTS:
With simple input functions (demographics, age, gender) the user selects from a predetermined menu variables relating to natural (e.g., airplane flights and geo-tracked background exposure), professional (e.g., cath lab workers) and medical (e.g., CT, cardiac scintigraphy, coronary stenting) sources. The programme provides a simple numeric (cumulative effective dose in milliSievert, mSv, and equivalent number of chest x-rays) and graphic (cumulative temporal trends of exposure, cancer cases out of 100 exposed persons) display.

CONCLUSIONS:
A simple software programme allows straightforward estimation of cumulative dose (in multiples of chest x-rays) and risk (in extra percentage of lifetime cancer risk), with simple numbers quantifying lifetime extra cancer risk. Pictorial display of radiation risk may be valuable for increasing radiological awareness in cardiologists.

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