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Keynote Lecture 4a
Training Users of Medical Radiation
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• Introduction
• Basic Aspects of Radiation Protection Training in Medicine
• Current Status of international recommendations and requirements for training
• Analysis of root causes of some current issues
• Current efforts and possibilities for the future
• Summary and conclusion
1. Introduction

- Training in Radiation Protection
  - Undergraduate
  - Postgraduate
  - Quality of Radiologist Training
  - Speed of technological advances
  - Sources of postgraduate training
  - Efforts by international groups
Volume of Procedures

In the year 2000 worldwide there were:

- 2 billion diagnostic x-ray examinations worldwide
- 32 million nuclear medicine examinations
- 5.5 million patients treated with radiation therapy
Several million persons are administering radiation

Reaching and educating these persons is essential

Accurate translation of materials is a major problem

Use of professional organisations and journals
2. Basic Aspects of Radiation Protection
Training in Medicine

- RP workers, public: ALARA
- Patients: different operational philosophy
- Main difference: patient receives benefit and gives informed consent
- Types of consent: diagnostic v. therapeutic
- Correct dose
• Radiation dose limits are not applicable to patients

• Use of Reference Doses to identify abnormally high doses and correct or justify
• Doses in use range from minute to fatal
• Hence standards and educational programs range from the minimal to highly specific
Any radiation protection system in medicine must be integrated with the practice of medicine if it is to be effective.
Justification and Optimisation

• Applied differently in medicine

• The initial idea is to justify a particular practice in medicine

• Mammography may be thought of as a practice

• Justified as has more benefit than risk with regard to detection v. induction of breast cancer
Mammography

- Justified in general
- Not justified for all women
- Must be justified on an individual basis

- All exposures must be Optimised
3. Current Status of international recommendations and requirements for training

- Most regulations or recommendations are very general

- Most users and organisations are free to provide whatever education they see fit

- ICRP: discussed education in various documents
• ICRP 60; 7.3; para 237: important need to provide adequate resources for education and training of future professional and technical staff in RP….These resources cannot be provided by regulatory agencies alone.

• ICRP 73 reiterates this and comments on specific needs for CT, intervention and radiotherapy
IAEA Safety Series

• Long recognised training as particular need in medical field

• Number 20; Section 2.5: appropriate training to correspond to practice and type of job…..

• Need for up to date information on diagnosis and treatment of radiation injuries…..

• Duration and depth of specialised training depends on level of responsibility and job complexity
IAEA Basic Safety Standards

• For use of a source: qualifications in RP of the medical practitioners to be detailed, or
• Only medical practitioners with qualifications in RP permitted to prescribe
• Medical Practitioners to ensure overall patient protection and safety during an exposure
• Training criteria to be specified or be approved by Regulatory Authority in consultation with relevant professional bodies
IAEA RP for Medical Exposure to Ionising Radiation, RS-G-1.5, 2002

- Specifically addresses training in medical exposure
- Extensive list of staff to be trained in RP and safety
- Level of training to depend on degree of specialisation of individuals, academic background and experience
- Requirements for this training are given
IAEA RP for Medical Exposure to Ionising Radiation, RS-G-1.5, 2002

- Must be able to demonstrate proof of training
- Issue certificates of authorisation to use
- Possible use of examinations or compulsory training courses
- Financial costs to be considered
Guidance on training in diagnostic radiology

- Physicians responsible for individual justification and conducting exposures
- Physicians in training
- Radiation technologists or equivalent staff
IAEA RP for Medical Exposure to Ionising Radiation, RS-G-1.5, 2002

- Regulatory authority should encourage health authorities, universities and professional associations to design and implement education and training programs in RP and safety for professional staff involved in diagnostic and interventional radiology
- Extent of this knowledge will vary, e.g. radiologist v. orthopaedic surgeon v. cardiologist
- Specific training for fluoroscopy, paediatric, interventional radiology
IAEA RP for Medical Exposure to Ionising Radiation, RS-G-1.5, 2002

• Similar specific guidance for nuclear medicine, but including radiopharmaceutical biokinetics, dosimetry, contamination control, waste management, etc

• Similar comments for radiation therapy

- Article 7: requirements for training
- Adequate theoretical and practical training for the purpose of radiological practices
- Competence in radiation protection
- Appropriate curricula to be established
- Continuing education and training after qualification to be provided, especially for new techniques
- RP course to be encouraged to be in undergraduate training

Member States to ensure that appropriate radiological equipment, practical techniques and ancillary equipment are used for the medical exposure of children, as part of a health screening program, involving high doses to patients, e.g. CT, Interventional radiology or radiotherapy
4. Analysis of root causes of some current issues

Two questions:
• What is wrong with the current education process?
• What are the problems that need to be fixed?
Examine R P problems that have arisen in medicine over last few years to find the root cause(s).
Some major issues

- Rapid development of new technologies
- Lack of integration of R P issues with training in the use of new technologies
- Lack of regulations and standards to keep up
- Rapid expansion of complex interventional procedures using fluoroscopy
U.S. Food and Drug Administration

- Issued warning 10 years ago
- High dose rates + long procedure times leads to real possibility of injury such as skin burns
The cause of these injuries is not a lack of standards, but rather a lack of education and understanding of radiation effects and radiation protection by physicians who are performing these procedures.
CT

- Recognised as high dose procedure for over a decade
- Doses often approach/exceed levels known to increase probability of cancer

- New advances of reduced scan times, more slices, more patients, more indications for use
- Trauma requests - whole body scan often
CT

- 11% procedures v. 70% dose
- Newer techniques have higher doses
CT dose management

- Reduction in mA
- Automatic exposure control

- Radiologists should say ‘No” more often
- They should challenge the clinical benefit of the scan in relation to the expected outcome and proposed treatment protocol
- Use Cochrane’s Law
CT dose management

- Adult v. Paediatric exposure factors
- Children to have specific protocols with lower exposure factors
- Trained paediatric technologists
Radiation Protection problems in CT primarily due to lack of education, training and a lack of customer demand on the manufacturers to produce acceptable images at lower patient doses
My philosophy

Do the correct examination once, after proper justification and clinical discussion, do it properly, and obtain the right result for the patient without unnecessary irrelevant procedures first.

It does not matter if this is a high dose procedure, provided the above requirements are fulfilled.
Digital Techniques and PACS

- Now installed in many departments
- Generally no training in managing image quality, patient dose or RP aspects
- Needed for radiologists, medical physicists, technicians
- Too easy to give higher dose than necessary
- Many image displays give no dose information
Digital Techniques and PACS

What to do?

- Patient dose parameters to be displayed at operator console and inside room for interventional procedures
- Use of DRLs
- Quality Assurance
- No more fluoro images than necessary
- Pulsed fluoroscopy
- Digital grab
Digital Techniques and PACS

A new concern - ?US only

- Referring clinicians ease of image/report review in own office seems to leading to multiple and or repeat requests
- Lack of proper justification
- RP training for referrers - required in EC
Nuclear Medicine

• Standards have existed for many years
• Significant variation between countries regarding regulations and restrictions
• European variations re hospitalisation
• Nuclear therapy tourism
• No hospitalisation in US
Nuclear Medicine

What are the causes of these variations?

- Use of models that are ultraconservative
- Societal misunderstanding of radiation effects
- Possible failure to use actual measurements to demonstrate compliance with standards
Radiation Oncology

• Despite a plethora of standards, continuing radiation therapy accident.
• Most have multi-factorial causes, but especially lack of training and application of existing standards
• Attempts to treat too many patients with too little equipment
• Inappropriate use of computerised planning systems
5. Current efforts and possibilities for the future
Discusses

• Classroom and distance learning
• On the job training
• Development of training objectives
• Training schedules
• Lesson plans, materials, practical sessions
• Assessment procedures
• Training facilities
• And more....
IAEA Safety Series Report No 20

- Excellent for nuclear power plants and other types of regulated facilities
- Complete rubbish in medical settings
- Justification and Optimisation are part of normal practice of medicine
Some difficulties with physicians

- ICRP recommendations rarely seen by a physician
- Physicians have little interest or time to attend courses on Radiation Protection
- RP matters usually relegated to medical physicists
- Many physicians have x-ray equipment and their offices are never or rarely visited by medical physicist
The Malaga Conference, 2001

- International Conference on the Radiological Protection of Patients in Diagnostic and Interventional Radiology, Nuclear Medicine and Radiotherapy
- International action plan for radiation protection of patients
- Training and education actions common to all aspects of the use of radiation in medicine
- 12 major recommendations
Committee 3, ICRP

- Developed new philosophy and approach to training of specific aspects of RP in medicine

- Most physicians would read sort documents related to specific issues, especially regarding new technologies
Committee 3, ICRP

- Pregnancy and medical radiation
- Management of dose in transition from film screen to digital radiography
- Dose management in CT
- Release of patients after therapy with both sealed and unsealed radionuclides
- Prevention of accidents in radiotherapy
- Special aspects of high dose rate brachytherapy
Significant problems remain

- Importance of training not adequately stressed in many international recommendations
- Merely to be a physician is enough in many countries
- ICRP Task Group examining issue of training and possible certification for some groups of medical users
- Also need to train radiographers, technicians and others using ionising radiation in medicine
Other efforts

- Spanish Royal Decrees on criteria for quality in radiodiagnosis
- Users accredited to a ‘second level’ of training in radiation safety
- MARTIR Project - Multimedia and Audiovisual Radiation Protection Training in Interventional Radiology
- EC Radiation Protection 119 CD-ROM
6. Summary and Conclusion
There are a number of current concerns regarding RP in medicine

- Many of these due to rapidly advancing technology and pressure to get new techniques into clinical practice
- Clinical pressure often eclipsed appropriate RP training
- Limited educational materials available
- Poor dissemination, unless developed and distributed with professional organisations
• Currently most successful strategy is to develop concise and technique specific user related documents and publish in medical journals

• Ongoing international efforts to examine the need for training and educational recommendations/standards for individual authorisation for medical staff to use new and especially high dose equipment
Choose: IRPA12, May 2008, Glasgow