Increasing role of medical physicist in radiation protection

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Medical Physicist in Radiology

1980's
- Who??
- What can he/she do?
- Radiotherapy
- Nuclear Medicine

2013
- Where is he/she??
- Fluoroscopy in
  - Cardiology
  - Electro-physiology
  - Vascular surgery
  - Urology
  - Gastroenterology
  - Orthopedic surgery
  - .......

- ...
1980’s

- Radiation safety was important but was dominated by occupational radiation protection,
- Reached level of good control

How many were concerned about dose monitoring to patients?

- ?????
- Very few

What could happen to patients? No skin injuries. Theoretical risk of cancer

1990s: A series skin injuries among patients undergoing interventional procedures
1990s

- Skin injuries in interventional procedures: Provided medical physicists new directions to develop expertise in patient dosimetry and dose management.

AJR issue with many articles & Editorial

Brenner, Lee Rogers, Paterson, Donolly, Nickoloff, Haaga

2000s

- Cancer risk in children: Provided medical physicists another directions to develop expertise in patient dosimetry and dose management.
- Brought radiation risks in public domain and created challenging situations for medical physicists.
Era on ATTENTION to dose in CT

Manufacturers vying with each other on Radiation Dose
Energy research

CT SAFETY AND EFFICACY

Safety and Efficacy of Computed Tomography (CT): A Broad Perspective

Computed tomography (CT), sometimes called a CAT scan, can provide highly detailed medical diagnosis with a relatively high exposure of patients to radiation. This project will undertake research that will provide health care.

Balancing safety, clinical need and cost

CT uses special X-ray equipment to obtain multiple images of the body from different angles, which are then combined to produce a 3D image. This technique is associated with relatively high radiation exposure for patients, accounting for 30-40% of the population's exposure to radiation. The project provides a comprehensive analysis of the risks and benefits of CT and investigates ways to minimize these risks while maintaining the high diagnostic accuracy associated with CT. The project will also develop strategies to balance the clinical needs of patients with the risks associated with the procedure. The project's findings will be used to develop safety guidelines and best practices for CT imaging. The project will also investigate the potential for using low-dose CT protocols and image reconstruction techniques to reduce radiation exposure for patients.

The project will address specific concerns related to CT, such as the low-dose CT protocols and image reconstruction techniques. The project will also investigate the potential for using low-dose CT protocols and image reconstruction techniques to reduce radiation exposure for patients. The project results will be used to develop safety guidelines and best practices for CT imaging. The project will also investigate the potential for using low-dose CT protocols and image reconstruction techniques to reduce radiation exposure for patients. The project results will be used to develop safety guidelines and best practices for CT imaging.

References: Abu Dhabi

CT in News

1. Higher doses to children (2001)
2. Cancer risks from CT (2002-2007)
Over-utilization of CT

Addressing Overutilization in Medical Imaging

CT exposure, 2011 (or nearest year)

1. Does not include hospital not included.
2. Rates or others not included.
3. Rates or others not included.
4. Rates or others not included.
CT in News

1. Higher doses to children (2001)
2. Cancer risks from CT (2002-2007-....)
3. Over-utilization of CT (2007-.....)

Number of CT Examinations

- 31,500 patients
- 190,712 CT examinations
- 22 year period

- 33%: > 5 CT exams
- 5%: 22-132 exams

Sodickson et al.
Radiology 251; 175-184,
2009

Estimated Cumulative Dose

- 15%, ED > 100 mSv
- 4%, 250 -1375 mSv
- 1% >389 mSv

Sodickson et al.
Radiology 251; 175-184,
2009
CT in News

1. Higher doses to children (2001)
2. Cancer risks from CT (2002-2007-....)
3. Over-utilization of CT (2007-.....)
4. Individual patient dose ≥ 100 mSv

1972-2007=35 years

CT Machines were most well behaved ones for 35 years
Right or WRONG, accidents drive safety

Take action before forced

Till skin injuries were reported, there was talk about CT dose reduction, but no hype or fear

Another Era started Patients/parents Public
• The increasing publications in journals,
• Recent changes in Safety Standards,
• California law,
• Increase responsibilities of medical physicists in patient protection.

Medical physicists without radiation?

Medical Physicists
• Number of Medical Physicists in the world: ~18 500
• Mean concentration: ~2.7 per million population
• In developed countries: (~15 – 20) per million population
• In developing countries: (~0 – 5) per million population
Medical exposure: Largest Source

Duties and Responsibilities

• Facility design
• Defining the technical specification of the equipment
• Establishing procedures, equipment quality assurance
• Radiological protection of the patient and (often) the workers
• Standards and regulations on radiation safety require MP
• MP Jobs in many countries are created on strength of radiation safety requirements

Core Tasks: Diagnostic Medical Physicist

• QA (on site),
• QA (analysis and reporting),
• Optimisation: troubleshooting protocols flagged by users,
• Optimisation: troubleshooting protocols flagged by dose audit, dose audit/calculation, acceptance/commissioning of systems, acceptance/commissioning of component e.g. x-ray tube/detector,
• Optimisation: setting up exposure protocols, examination of newly installed equipment for the purposes of ensuring the safety features and warning devices operate correctly and there is sufficient protection provided, together with other support/advice
Other activities: Diagnostic Medical Physicist

• Advising on and reviewing clinical research studies,
• delivering teaching and training,
• research and development,
• radiation protection for new installations,
• audit of facilities for regulatory compliance,
• review of personal monitoring,
• testing protocol development and management.

Almost a thing of past for staff in medical

But this is IN
Changing scenario

1980’s
• QC/QA

2010’s
• Patient dose assessment
• Dose management
  – Actual
  – Training

Then & Now

1980’s
• Regulatory

2010’s
• Regulatory requirements
• Work requirements

Competition

Radiology
• Ultrasound
• Radiography
• CT
• Interventional

Medical Physics
• QC
• Dosimetry
• Safety

Problem: Lack of enough competition
Future

- In coming years medical radiation protection may emerge as a specialty
- Already IAEA has a separate RPOP Unit
- Challenge to deal with

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