**Patient Radiation Exposure Tracking**

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**Why Track Previous Exposures?**

There was never a time in history when radiation dose to an individual patient from diagnostic examinations was in the range of 100 mSv of effective dose.

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**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

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**Estimated Cumulative Dose**

- 15%, ED > 100 mSv
- 4%, 250 -1375 mSv
- 1% >399 mSv

Sodickson et al.
Radiology 251; 175-184, 2009
• Remember MDCT came in 1999 and became popular in 2001 or so
• Surveys in future are going to show much more

Multiple CT studies
• Jaffe et al. (Duke) Radiation doses from small-bowel follow-through and abdominopelvic MDCT in Crohn's disease. AJR 2007 Nov;189(5):1015-22; 3% patients had more than 10 CT examinations
• Richard and Sodickson. Cumulative Radiation Exposure and Cancer Risk Estimates in Emergency Department Patients Undergoing Repeat or Multiple CT. AJR 2009, 192:887–892; Number of studies: mean 13.4, maximum 70

• Not that extreme cases should dominate in decision making, but the fact that higher exposure can occur and
• at levels where deterministic effects may not happen, individual stochastic risks cannot be ignored
Did anyone see this 6 years ago, as a result of CT?

- More than 350 patients reported in 2008-2010
- Brain perfusion CT
- Did ANYONE expect this to happen 6 years ago?
  - NO

Repeated high dose procedures on the same patient in few years

- Was this situation 20 years ago?
  - No
  - 10 years ago
  - Partially, primarily for interventional procedures

- What has been added mainly in last 10 years
  - CT examinations (MDCT)
  - Digital radiography, but that involves much smaller doses

Learning Objectives: To understand

- Underlying basis for cumulative assessment of radiation exposure of the patient in series of examinations and procedures.
- Issues involved in tracking of series of radiological procedures and radiation doses.
- Current status globally and the way forward to achieve tracking of radiological procedures for an individual patient
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United Nations Scientific Committee on Effects of Atomic Radiation (UNSCEAR)

- UNSCEAR: 2.5 billion>>>3.6 billion/yr
- The emphasis in past has been on collective dose as a basis for Radiation Protection.

Patient Radiation Exposure Tracking

Cumulative dose to an Individual patient

Survey for SmartRadTrack

1. Afghanistan
2. Armenia (2)
3. Australia
4. Azerbaijan
5. Bangladesh
6. Bermuda
7. Bhutan
8. Bosnia and Herzegovina (2)
9. Brazil
10. Bulgaria
11. Canada (4)
12. Chile
13. China (2)
14. Colombia
15. Costa Rica
16. Côte d’Ivoire - Laboratoire National de la Sante Publique
17. Croatia (2)
18. Cuba
19. Cyprus
20. Czech Republic (2)
21. Dem Rep of Congo
22. Egypt
23. El Salvador
24. Estonia (2)
25. Ethiopia
26. Finland
27. Gabon
28. Georgia
29. Greece
30. Hong Kong, China (2)
31. Hungary (2)
32. India (2)
33. Indonesia (2)
Which exposures?

- Diagnostic
- Interventional
- Therapy (because purpose is to give radiation)

We all know that

- Cumulative dose for staff - practiced for many decades
- Patient - new
Why not for patient in the past?

• No dose limit for patient*
• Dose quantities were not standardized
• How to measure or estimate dose?

*No intention to have dose limit now

WHY?

• Innate tendency to KNOW
  • Knowledge is power
  • Educational intent
  • Satisfying human curiosity
  • Not always to use it
  • “Managing in the presence of information is better than in its absence”

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Nomenclature: Card

• People get a feeling that the card will have all information on it in particular dose
• But that problem can also be with all cards: ATM, credit card……
• Card is only a identifier, digital signature
• Radiation passport has been around
Is there a place for Card?

Why should we label this with Card
- Smart Card, Smart access, Smart Protection
- ProSmartRad - Protection by Secure Measurement And Record Tracking of Radiation And Dose
- SmartRad Protection
- SmartRad - Secure Measurement And Record Tracking of Radiation And Dose
- Radioexaming wisely; Radioexaming smartly
- Radioexam Tracked or Radioexam Tracking
- We Image Smartly; SMART Patient Imaging
- Radiation SmartTrack; TrackSmarter

1. Only basic: card still remains even if on paper
2. Only Hospital: as Patient identifier, this is the best option and is being used widely
3. Group of hospitals: Same
4. Cross country: Same
5. Global: Same
Easy to speak, write, communicate

Critics
- Not feasible
- Why? What are you going to use it for?
- It may implicate staff for having given more radiation dose to patient.

Situation before 2008

FUTILITY
No matter how hard you try, you will fail.
Situation before 2008

Looking back

- It was good that I did not pursue it aggressively about 5 years ago
- Radiation units were not as matured e.g. in interventional procedures
- PACS not talking to each other
- e-Health, the heart and soul of this project, was in infancy
- Reports of 100 mSv doses to an individual were not there

IAEA Bulletin May 2009

Smart Protection
A 'smart card' that contains patients' information including radiation dose data would help protect them from radiation effects.

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Une protection intelligente
Une carte à puce pourrait servir de cahier électronique d'irradiation médicale pour les patients qui le souhaitent.

Jusqu'à la

Radiation Record Card

IAEA

Newsletter
International Society of Radiology
Jan Labarrack, MD — Secretary General

August 2009

IAEA MOUNTS EFFORT TO RECORD PATIENT DOSE

In April of this year, the International Atomic Energy Agency announced a new project to record medical radiation exposure to patients over a lifetime. Besides calling attention to the increased exposure from the use of medical radiation, the project also aims to provide a tool to patient exposure from CT scans as distinct from traditional x-ray examinations, said Madan Rehani, an IAEA radiation safety specialist.

The IAEA has invited the ISRG and other international organizations to participate in the design of a “smart card” which people might carry to record their radiation exposure over a lifetime. How such a system might function has not been determined, he said.
Tracking radiation exposure of patients

Rehani & Frush. The Lancet 376 (9743); 754-755

Lancet Sept.2010
Most basic: paper card

Like Vaccination card

Merits:
- Helps tracking of individual exposure history
- Can serve a great deal of purpose
- Is very good so long as it is maintained and used

Demerits:
- Record is only with patient, not with health care system
- Is highly dependent upon patient and health care provider
1. What is current status of tracking at a hospital level?

- It is a reality in thousands of hospitals now.
- PACS systems have the capability
- IHE-REM, Structured dose reports- Imaging machines from different vendors is possible.
- Sweden, Finland, Malta, UAE, many European countries, North America, US…..
- It was NOT SO few years ago.

2. Situation beyond a hospital?

- Yes, it is a reality
- Few tens of hospitals with imaging equipment from different vendors are currently having this
3. At National Level

- Unique patient identifier (Sweden…)
- National PACS (many European countries)
- Some countries, it is already well planned and reasonably implemented but not many know about it
- Technically feasible, but it requires management and political support
- Expected that few tens of countries to have it in coming 3 years

MoU US & Europe for health care data exchange

Unique Card Number

- World Population 6.7 billion
- Credit Cards have already 16 digits. That can cover all people in world
- BUT health system unfortunately has not been as sexy to global service providers as financial

Issues nearly Resolved

- Use of reference dose quantities (e.g. DLP & CTDI in CT; KAP & CAK in fluoroscopy …)
- CT & fluoroscopy have dose displays & records
- DICOM- communication of images
- IHE- REM communication of dose
Unresolved issues & practicability

- Use of patient identifiers
- Off line studies
- Systems not connected by central PACS

Should patient be provided dose information?

- Depends upon local regulations
- Patient needs confidence in facility:
  - Assurance that dose in any examination is well within DRL
  - Accreditation of facility & staff
  - Regular monitoring of dose
- If patient asks, he/she should be provided information

PATIENT EXPOSURE TRACKING: THE IAEA SMART CARD PROJECT

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INTRODUCTION

John comes to the Emergency Room (ER) with colicky abdominal pain. The physician suspects a renal calculus (kidney stone). Physician: ‘John, we are worried about a kidney stone and would like to look for this by doing a computed tomography (CT) of your abdomen’. John: ‘I have been to different ERs several times in the last six months and it seems they had performed some imaging procedures which have always come out normal’. Physician: ‘John, this is an urgent matter and I would rather get the CT scan as soon as possible than waste more time’. John: ‘OK doctor, whatever you feel is best for my health’.
What Further

- To develop guidance where the number of procedures alone (low dose exams e.g. radiography), rather than dose, are sufficient
- To deliberate on actions needed for nuclear medicine procedures
- Offline studies
- Practical issues
- Management & political levels action

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