Quality Management and enhancing best practices in Radiology

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IAEA
International Atomic Energy Agency

Learning Objectives

- Understand concepts of quality in radiology
- Understand the use of image quality parameters in radiological imaging
- Understand role of professions in enhancing quality and safety in radiological practice

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Content

- Concepts of Quality Assurance in Radiology
- Image Quality
- Patient Dose
- Multi-disciplinary approch

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Concepts of Quality Assurance in Radiology

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Quality Assurance in Radiology

- Quality assurance (QA) is a program used by management to maintain optimal diagnostic image quality with minimum hazard and distress to patients. The program includes periodic quality control tests, preventive maintenance procedures, administrative methods and training. It also includes continuous assessment of the efficacy of the imaging service and the means to initiate corrective action.

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Quality Assurance

- Primary objective is the enhancement of patient care; this includes patient selection parameters and scheduling, management techniques, departmental policy and procedures, technical effectiveness and efficacy, in-service education, and image interpretation with timeless of reports

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Radiology Department QA Committee (QAC)

- A QAC will also provide management with recommendations for direction to those charged with the various aspects of the program
- The QAC should have an overall documented strategy with clearly defined work plans to achieve the goals and objectives of the radiology department.
- The committee should include representatives from all levels of the radiology staff, meet a regular intervals and report directly to the department's management.

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Radiology Department QA Program

- A documented QA program should be developed, under the guidance of the QAC, specifically to address the needs of the radiology department
- The QA program should include a written plan of action outlining policies and procedures
- The QA program should cover both QC testing techniques and administrative procedures.

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QA Personnel Training

- The QA program should include the means to provide appropriate training for all personnel with QA responsibilities and especially those directly involved with QC testing. A continuing education program is necessary to keep personnel up-to-date. Since QC training is expensive, yet proven to be cost effective, effort will be required by hospital management to ensure that adequate financial provision be available to meet this requirement.

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Quality Control

- Quality control (QC) consists of a series of standardized tests developed to detect changes in x-ray equipment function from its original level of performance. The objective of such tests, when carried out routinely, allows prompt corrective action to maintain x-ray image quality. It is important to note that the ultimate responsibility for quality control rests with the physician in charge of the x-ray facility, not with the regulatory agency.

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Quality Control; Levels of Testing

- Level 1: Non-invasive and Simple
  - Perform by technologists
- Level 2: Non-invasive and Complex
  - Perform by technologists trained in QC procedures using more sophisticate equipments
- Level 3: Invasive and Complex
  - Involves some disassembly of the equipment, normally perform by engineers or physicists

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Goal of QA Program

- To maintain the quality of diagnostic images
- To minimize the radiation exposure to patient and staff
- To be cost effective

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Image Quality

Image Quality

- Outcome measure: usefulness in determining diagnosis
- Objective measures:
  1. Contrast
  2. Spatial Resolution
  3. Noise

Questions of (Radiographic) Character: Image Quality

Contrast What is range of tone (grayscale)?

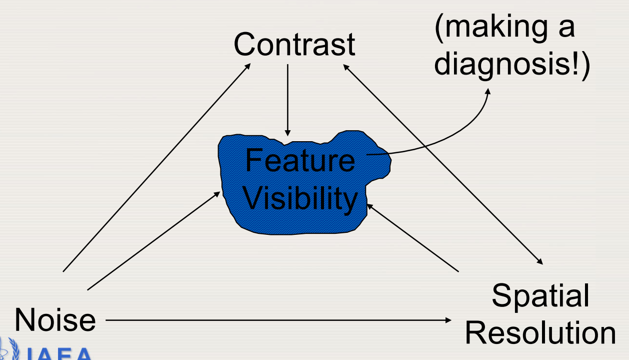
(Film Exposure Where is that range centered?)

Resolution What is the smallest detail visible?

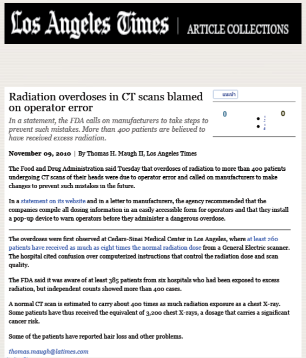
Noise How much bad information?

Constraint: How much patient dose will we tolerate?

Factors of Image Quality: Contrast, Noise, and Resolution



From the news



Radiation overdoses in CT scans blamed on operator error

In a statement, the FDA calls on manufacturers to take steps to prevent such mistakes. More than 400 patients are believed to have received excess radiation.

November 09, 2010 | By Thomas H. Maugh II, Los Angeles Times

The Food and Drug Administration said Tuesday that overdoses of radiation to more than 400 patients undergoing CT scans of their heads were due to operator error and called on manufacturers to make changes to prevent such mistakes in the future.

In a statement on its website and in a letter to manufacturers, the agency recommended that the companies compile all dosing information in an easily accessible form for operators and that they install a pop-up device to warn operators before they administer a dangerous overdose.

The overdoses were first observed at Cedars-Sinai Medical Center in Los Angeles, where at least 260 patients have received as much as eight times the normal radiation dose from a General Electric scanner. The hospital cited confusion over computerized instructions that control the radiation dose and scan quality.

The FDA said it was aware of at least 385 patients from six hospitals who had been exposed to excess radiation, but independent counts showed more than 400 cases.

A normal CT scan is estimated to carry about 400 times as much radiation exposure as a chest X-ray. Some patients have thus received the equivalent of 3,200 chest X-rays, a dosage that carries a significant cancer risk.

Some of the patients have reported hair loss and other problems.

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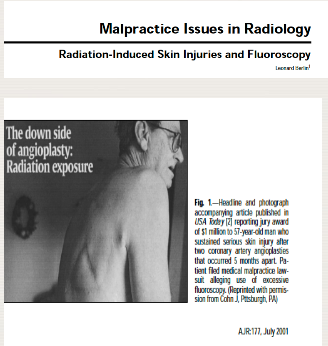

Malpractice Issues in Radiology

Radiation-Induced Skin Injuries and Fluoroscopy

Leonard Berlin[1]

Fig. 1.—Headline and photograph accompanying article published in *USA Today* [2] reporting jury award of $1 million to 57-year-old man who sustained serious skin injury after two coronary artery angioplasties that occurred 5 months apart. Patient filed medical malpractice lawsuit alleging use of excessive fluoroscopy. (Reprinted with permission from Cohn J, Pttsburgh, PA)

AJR:177, July 2001

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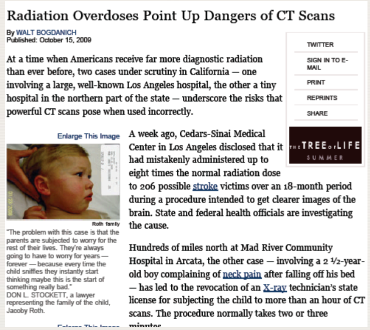
From the news



Radiation Overdoses Point Up Dangers of CT Scans

By WALT BOGDANICH
Published: October 15, 2009

At a time when Americans receive far more diagnostic radiation than ever before, two cases under scrutiny in California — one involving a large, well-known Los Angeles hospital, the other a tiny hospital in the northern part of the state — underscore the risks that powerful CT scans pose when used incorrectly.

A week ago, Cedars-Sinai Medical Center in Los Angeles disclosed that it had mistakenly administered up to eight times the normal radiation dose to 206 possible stroke victims over an 18-month period during a procedure intended to get clearer images of the brain. State and federal health officials are investigating the cause.

Hundreds of miles north at Mad River Community Hospital in Arcata, the other case — involving a 2 ½-year-old boy complaining of neck pain after falling off his bed — has led to the revocation of an X-ray technician's state license for subjecting the child to more than an hour of CT scans. The procedure normally takes two or three minutes.

"The problem with this case is that the parents are subjected to worry for the rest of their lives. They're always going to have to worry for years — forever — because every time the child sniffles they instantly start thinking maybe this is the start of something really bad." DON L. STOCKETT, a lawyer representing the family of the child, Jacoby Roth.

CA state fined the hospital $25,000, additional lawsuit from family

The child received 2.8-11 Gy radiation dose at different organs.

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Exposure to Medical Radiation

- Occupational Exposure
  - Exposure to radiation from work related activities
  - Limit applied (20 mSv per year)
- Public Exposure
  - Exposure to radiation by members of public
  - Limit applied (1 mSv per year)
- Medical Exposure
  - Exposure to medical radiation, imaging and therapy
  - No limit
  - Justification and optimization applied

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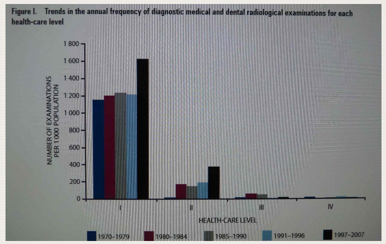
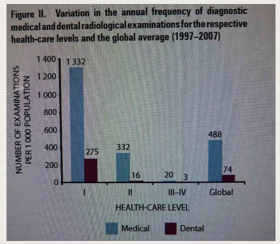
The Use of Diagnostic Radiation





UNSCEAR 2008

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Dose from Imaging and Interventional Procedures

- Imaging
  - Normally low dose
  - Stochastic Risk
  - Dosimetry mainly for optimization
  - Sometimes effective dose is used
- Interventional Radiology
  - Moderate to high dose
  - Concern for deterministic effects to skin

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Q. What is the lowest doses of low LET radiations at which clear evidences of cancer risks are shown ?

Acute exposure

Adults ~ 10-50 mSv (Brenner, PNAS 2003,100:137-61)

Childhood cancer risk(in utero exposure) ~ 6-10 mSv

(Doll,BJR 1997, 70: 130-9)

Protracted exposure

Occupational workers ~ 50-100 mSv

(Brenner, PNAS 2003,100:137-61)

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What we know

- UNSCEAR (2008) - Life-time risk of dying from radiation induced cancer = 5% per sievert
- ICRP recommends that the risk of fetal cancer in population receiving 1 mSv is taken to be 5 in 100,000 (0.005%)

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Medical Exposure

It is the largest contributor to the exposure of the general population from artificial sources

Annually worldwide

3,600 million X-ray exams (> 300 million in children)

37 million nuclear medicine procedures

7.5 million radiation oncology treatments

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Source: WHO

Lancet 2004; **363:** 345–51

Risk of cancer from diagnostic X-rays: estimates for the UK and 14 other countries

	Annual X-rays per 1000*	Males		Females		Total	
		Attributable risk (%)	Cases cancer per year	Attributable risk (%)	Cases cancer per year	Attributable risk (%)	Cases cancer per year
Country							
Australia	565	1·2	204	1·5	227	1·3	431
Canada	892	1·1	406	1·0	378	1·1	784
Croatia	903	1·5	66	2·2	103	1·8	169
Czech Republic	883	0·9	67	1·2	105	1·1	172
Finland	704	0·7	20	0·7	30	0·7	50
Germany	1254	1·3	963	1·7	1086	1·5	2049
Japan†	1477	2·9	3724	3·8	3863	3·2	7587
Kuwait	896	0·7	25	0·6	15	0·7	40
Netherlands	600	0·7	100	0·7	108	0·7	208
Norway	708	1·3	28	1·1	49	1·2	77
Poland	641	0·5	99	0·7	192	0·6	291
Sweden	568	1·1	91	0·8	71	0·9	162
Switzerland	750	1·0	93	1·0	80	1·0	173
UK	489	0·6	341	0·6	359	0·6	700
USA	962	0·9	2573	1·0	3122	0·9	5695

*Taken from worldwide survey.[1] †Estimates assume annual frequency of CT examinations in Japan was equal to that for all health-care level 1 countries. However, number of CT scanners per million population in Japan is 3·7 times that for all health-care level 1 countries. If this number is reflected in annual frequency of CT examinations, then for Japan estimated annual number of X-rays per 1000 increases to 1573 and the attributable risk increases to 4·4%, corresponding to 9905 cases of cancer per year.

Table 6: **Frequency of diagnostic X-rays per 1000 population, percentage of cumulative cancer risk to age 75 years attributable to diagnostic X-rays, and number of radiation-induced cases of cancer per year for 15 countries**

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Joint Position Statement on the IAEA Patient Radiation Exposure Tracking

The IAEA Smart Card/SmartRadTrack Project aims at enhancing the implementation of principles of justification and optimization for radiation protection of patients. As quoted from Robert Glass earlier in the summary of the first meeting of the Smart Card Project, "Managing in the presence of data is far better and easier than managing in its absence". It is believed that referring physicians will be in a better position to achieve appropriateness when provided information about previous radiological examinations and radiation doses of patients. A recent survey by the IAEA among referring physicians, currently under publication, confirms this belief.

The joint position statement is currently endorsed by the World Health Organization (WHO), the U.S. Food and Drug Administration (FDA), the European Society of Radiology (ESR), the International Organization for Medical Physics (IOMP), the International Society of Radiographers and Radiological Technologists (ISRRT) and the Conference of Radiation Control Program Directors (CRCPD) of USA.

Summary of the statement: Radiation protection of patients includes accountability for radiation exposure from multiple medical imaging procedures. While there are challenges, it has become increasingly necessary for organizations and professional communities to embrace a patient radiation exposure tracking programme for many reasons, in particular patient safety and welfare.

It is believed that organizations involved will take necessary actions to standardise the dose data provided by imaging equipment. It is important to be aware that, currently, only dose estimates are provided and not the actual individual patient dose. There is need to standardise the terminology of examinations.

Smart Card

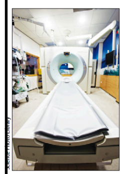
Cataract Study

Posters

RPOP VIDEO

Patient dose tracking

Tracking radiation exposure of patients



As recently as only 6 years ago, it was not possible to come across a radiation-induced skin injury (erythema such as a burn, or hair loss) to a patient resulting from CT. However, in 2009–10, overexposure of about 400 patients undergoing brain-perfusion CT protocols, resulting in hair loss or skin redness in some patients, was brought to the attention of the US Food and Drug Administration[1] and in media reports. 20 years ago, it was not possible to come across a patient who had undergone scores of CT scans in a few years, especially the patient without cancer. Did we see this coming? The answer is largely "no" for visible radiation effects and "probably yes" for usage. In view of these recent events, what might be the scenario in a few years? There are no indications that the increase in CT use will decrease. On the contrary, CT might replace some traditional fluoroscopy-based angiographic procedures.[2] The medical profession has a responsibility to account for radiation exposure from medical imaging.

What are the risks and are the risks real? Essentially there are two types of radiation effects. Ones that are visible, documented, and confirmed (deterministic effects:

754 www.thelancet.com Vol 376 September 4, 2010

M.Rehani and Frush D., Lancet, Vol 376, Sept, 2010

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Patient dose tracking

"It's only been two years since the phased implementation of centralised patient radiation exposure tracking in Egypt, but there's already been a significant change, especially in referring physicians," says Dina El Husseiny of Egypt's National Centre for Radiation Research and Technology.

"Since doctors know that they are being audited by the Central Directorate of Radiology, they are more careful about the number and type of diagnostic imaging procedures they write for patients," says El Husseiny.

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IAEA Project on Justification

IAEA, Vienna, 2012

Regional Project, Asia/Pacific, Seoul, Korea , 2013

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Justification of Medical Exposure

The British Journal of Radiology, 85 (2012), 523–538

Justification of diagnostic medical exposures: some practical issues. Report of an International Atomic Energy Agency Consultation

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Objectives: The Radiation Protection of Patients Unit of the International Atomic Energy Agency (IAEA) is concerned about the effectiveness of justification of diagnostic medical exposures. Recent published work and the report of an initial IAEA consultation in the area gave grounds for such concerns. There is a significant level of inappropriate usage, and, in some cases, a poor level of awareness of dose and risk among some key groups involved. This article aims to address this.
Methods: The IAEA convened a second group of experts in November 2008 to review practical and achievable actions that might lead to more effective justification.
Results: This report summarises the matters that this group considered and the outcome of their deliberations. There is a need for improved communication, both within professions and between professionals on one hand, and between professionals and the patients/public on the other. Coupled with this, the issue of consent to imaging procedures was revisited. The need for good evidence-based referral guidelines or criteria of acceptability was emphasised, as was the need for their global adaptation and dissemination.
Conclusion: Clinical audit was regarded as a key tool in ensuring that justification becomes an effective, transparent and accountable part of normal radiological practice. In summary, justification would be facilitated by the ''3 As'': awareness, appropriateness and audit.

Key Points:

Clinical Audit is a key tool

Justification would be facilitated by '3A"

1. Awareness
2. Appropriateness
3. Audit

Potential for unlimited exposure

- High Level Control (HLC)
- Fluoroscopic studies
- Any and all digital imaging
  - CR
  - DR
  - CT

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Typical effective doses from IR (Stochastic-cancer risk)

Adult Effective Doses for Various Interventional Radiology Procedures

Examination	Average Effective Dose (mSv)*	Values Reported in Literature (mSv)
Head and/or neck angiography	5	0.8–19.6
Coronary angiography (diagnostic)	7	2.0–15.8
Coronary percutaneous transluminal angioplasty, stent placement, or radiofrequency ablation	15	6.9–57
Thoracic angiography of pulmonary artery or aorta	5	4.1–9.0
Abdominal angiography or aortography	12	4.0–48.0
Transjugular intrahepatic portosystemic shunt placement	70	20–180
Pelvic vein embolization	60	44–78

* Values can vary markedly on the basis of the skill of the operator and the difficulty of the procedure.

IAEA Mettler et al., Effective doses in Radiology and Nuclear Medicine, Radiology 2008

Potential Effects in Skin (Deterministic Effects)

Table 2
Potential Effects in Skin from Single Exposures

Effect	Dose rad	Dose Gy	Onset	Peak
Early transient erythema	200	2	Hours	~24 h
Main erythema	600	6	~10 d	~2 wk
Temporary epilation	300	3	~3 wk	NA
Permanent epilation	700	7	~3 wk	NA
Dry desquamation	1,000	10	~4 wk	~5 wk
Moist desquamation	1,500	15	~4 wk	~5 wk
Late erythema	1,500	15	~6–10 wk	NA
Dermal necrosis (phase 1)	1,800	18	>10 wk	NA
Dermal atrophy				
Phase 1	1,000	10	>14 wk	NA
Phase 2	1,000	10	>1 y	NA
Skin cancer	Unknown	Unknown	>5 y	NA

Note.—NA = not applicable. Adapted from reference 21.

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Radiographics 1999; 19: 1289-1302

Why we pay more attention intervention radiology?

Cumulative dose of 20 Gy from one angiography and two angioplasty

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Source: The US FDA

If you look closely in your Department…

biij
Biomedical Imaging and Intervention Journal
ORIGINAL ARTICLE

Evaluation of radiation dose to patients undergoing interventional radiology procedures at Ramathibodi Hospital, Thailand

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ABSTRACT

Purpose: This study was carried out to assess the radiation dose to patients undergoing interventional radiology procedures at Ramathibodi Hospital, Bangkok, Thailand.

Methods: Data were collected from 60 patients under transarterial oily-chemoembolisation (TOCE) and femoral angiography performed with the Toshiba Infinix model VC-i FPD single plane system. Data were also collected from 60 patients who underwent brain arteriovenous malformations (AVM) and dural-arteriovenous fistula (DAVF) embolisation, performed with the Toshiba Infinix model VF-i bi-plane systems. A built-in air kerma area product (KAP) meter calibrated *in situ* was used for the skin dose calculation.

Results: The calibration coefficient of air kerma area product meter at tube voltage between 50 kV and 100 kV was found to vary within ± 5.07%, ± 7.2%, ± 4.86 % from calibration coefficient of 80 kV for a single-plane, tube 1 and tube 2 of bi-plane x-ray system, respectively. Mean air kerma area product values were 90.99 ± 52.89, 31.02 ± 17.92, 33.11 ± 23.99 (Frontal), 35.01 ± 19.10 (Lateral), 50.15 ± 44.76 (Frontal), 97.31 ± 44.12 (Lateral) Gy-cm^2 for transarterial oily-chemoembolisation, femoral angiography, diagnostic cerebral angiography, therapeutic cerebral angiography, respectively. The therapeutic cerebral angiography procedure was found to give the highest entrance dose, number of images and fluoroscopy time: 362.63 cGy (Lateral), 1015 images (Lateral) and 126 minutes, respectively. However, the highest air kerma area product value was from transarterial oily-chemoembolisation with 264.37 Gy-cm^2. There were 2 cases of therapeutic cerebral angiography, where the patient entrance dose was higher than 3 Gy in the frontal view, which reached the deterministic threshold for temporary epilation.

Conclusion: Very wide variationswere found in patient dose from different interventional procedures. There is a need for a dose record system to provide feedback to radiologists who perform the procedures; especially in cases where the dose exceeds the deterministic threshold. © 2011 Biomedical Imaging and Intervention Journal. All rights reserved.

Keywords: Radiation doses, Patient doses, Air Kerma Area Product (KAP), Entrance dose, Interventional Radiology.

Table 3 Mean Fluoroscopy, KAP and ED of this study and other study.

Procedure		Study	Mean Fluoroscopy time (min)	Mean KAP (Gy-cm^2)	Mean ED (mGy)
TOCE		This study	14.94	90.99	394.86
		Wongsanon S., et al. [12]	8.58	121.09	370
		Donald L., et al.[13]	16.8	282.32	1,406
		Vano et al. [14]	-	81.7	500
Femoral angiography		This study	5.9	31.02	100.36
		Vano et al. [14]	-	66.6	-
		Ioaninis A. Tsalafoutas, et al. [15]	2.6	68	257
		McParland [16]	7.2	46.7	-
Diagnostic cerebral angiography	Frontal	This study	13.27	33.11	400.40
	Lateral			35.01	154.77
		Ioaninis A. Tsalafoutas, et al. [15]	4.3	50	349
		McParland [16]	12.1	74.1	220
		Marshall, et al. [17]	-	48.5	150
Therapeutic cerebral angiography	Frontal	This study	40.1	50.15	876.52
	Lateral			97.31	591.93
		Donald L., et al.[13]	92.5	339.76	3791
		McParland [16]	34.1	105	-
		Marshall, et al. [17]	-	122	-

There were 2 cases of therapeutic cerebral angiography, where the patient entrance dose was higher than 3 Gy in the frontal view, which reached the deterministic threshold for temporary epilation.

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Typical effective doses from CT

Adult Effective Doses for Various CT Procedures

Examination	Average Effective Dose (mSv)	Values Reported in Literature (mSv)
Head	2	0.9–4.0
Neck	3	. . .
Chest	7	4.0–18.0
Chest for pulmonary embolism	15	13–40
Abdomen	8	3.5–25
Pelvis	6	3.3–10
Three-phase liver study	15	. . .
Spine	6	1.5–10
Coronary angiography	16	5.0–32
Calcium scoring	3	1.0–12
Virtual colonoscopy	10	4.0–13.2

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Mettler et al., Effective doses in Radiology and Nuclear Medicine, Radiology 2008

Safety concerns in CT

- The US FDA issued FDA public health notification on reducing radiation risk from CT for pediatric and small adult patients (Nov 2001)
- The ACR – children have more rapidly dividing cells than adults and have longer life expectancy, the odds that children will develop cancers from x-radiation maybe significantly higher than adults
- The US National Research Council's Committee on the Biological Effects of Ionizing Radiation – children less than 10 years of age are several times more sensitive to radiation than middle aged adults
- Unnecessary radiation maybe delivered when CT scanner parameters are not appropriately adjusted for patient size.

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CT Optimization

- Evaluate and improve clinical performance
  - Advocate appropriate equipment use & compliance protocols
  - Provide training, e.g., "down size" protocol for children, single phase, limit to indicated areas
  - Implement QA program & corrective actions
    - Audit and review DRLs, diagnostic data and image quality
- Assess and improve scanner performance
  - Performance parameters; resolution, contrast, noise
  - Scanner dosimetry
- Eliminate inappropriate referrals for CT

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Multi-professional work

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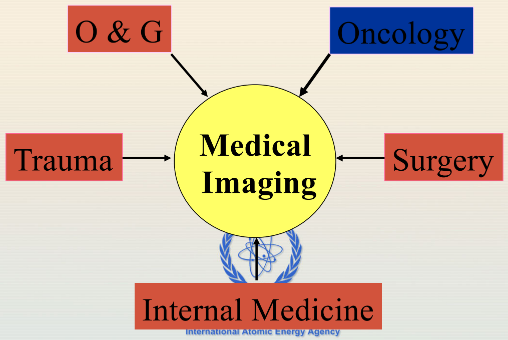
Modern Medicine is ***Image-centric***



Excellence requires development and implementation of

best practice, clinical guidelines,
quality assurance,
standards, audit,
and outcome assessment

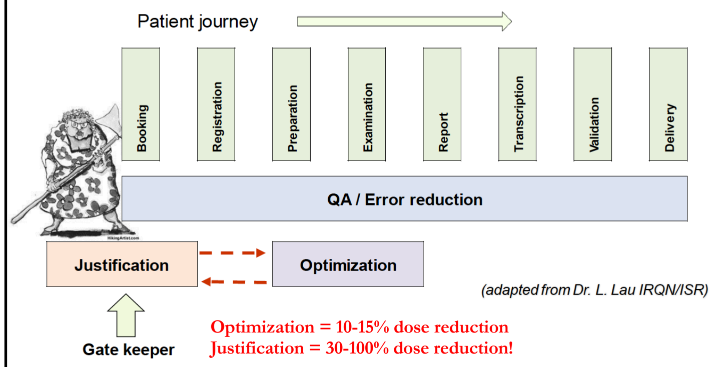
Medical imaging equipment and procedures must be monitored

quality control (QC),
quality assessment and improvement (QAI), continuous quality improvement /
total quality management (CQI/ TQM)

A team effort in clinical setting

- Radiologist – lead the effort
  - Clinical information
  - Image quality
  - Protocol design
- Medical Physicist – important role
  - Parameters affecting IQ and dose
  - Patient dose monitoring and audit
  - Protocol management (in many places = Technologist's role)
- Technologist – key player
  - Can it be done or not?
  - Practical concern
  - Patient instruction
  - Workflow

Multi-disciplinary effort for dose reduction



Radiologists

- Gate Keeper
- Major role in justification
- Imaging protocol design
  - Low dose imaging, when possible
    - Keep in mind image quality vs dose – how far can you go?
    - Medical physicists can help
  - Pediatrics protocols
  - Disease specific protocols

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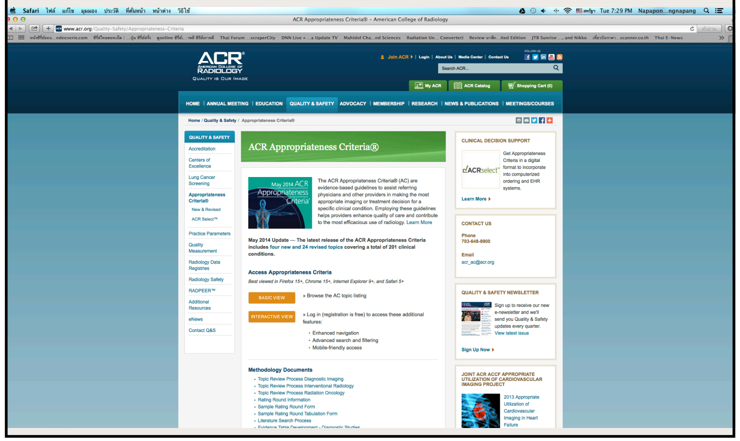
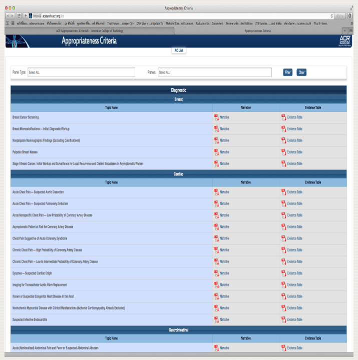
ACR appropriateness criteria



ACR appropriateness criteria



Date of origin: 1998
Last review date: 2014

American College of Radiology
ACR Appropriateness Criteria®

Clinical Condition: **Acute Chest Pain — Suspected Aortic Dissection**

Radiologic Procedure	Rating	Comments	RRL*
X-ray chest	9	This procedure should be performed if readily available at the bedside and if it does not cause delay in obtaining a CT or MRI scan. Alternative causes of chest pain may be discovered. This is not the definitive test for aortic dissection.	☢
CTA chest and abdomen with contrast	9	This procedure is recommended as the definitive test in most patients with suspicion of aortic dissection.	☢☢☢☢
MRA chest and abdomen without and with contrast	8	This procedure is an alternative to CTA for contraindication to CT (iodinated contrast), multiple prior chest CTA for similar symptoms, and in patients showing no signs of hemodynamic instability. Scanner availability and local expertise limit widespread use, as there is potential for delay in diagnosis. See statement regarding contrast in text under "Anticipated Exceptions."	O
US echocardiography transesophageal	8	Consider this procedure if a skilled operator is readily available.	O
MRA chest and abdomen without contrast	7	This procedure is an alternative to CTA for patients with contraindication to both iodinated and gadolinium contrast agents, such as in patients with renal failure, patients with multiple prior chest CTA for similar symptoms, and in patients showing no signs of hemodynamic instability. Scanner availability and local expertise limit widespread use, as there is potential for delay in diagnosis.	O
Aortography chest and abdomen	5		☢☢☢☢
US echocardiography transthoracic resting	4		O
FDG-PET/CT skull base to mid-thigh	3	This procedure is not recommended as the initial test. It may be useful for prognostication and for distinguishing acute from chronic dissection.	☢☢☢☢
Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate			*Relative Radiation Level

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ESR- EuroSafe

EuroSafe Imaging Call for Action

- **Action 1:** Develop a Clinical Decision Support system for imaging referral guidelines in Europe
- **Action 2:** Develop and promote a clinical audit tool for imaging to increase the quality of patient care and improve justification
- **Action 3:** Implement measures to maintain radiation doses within diagnostic reference levels (DRLs)
- **Action 4:** Promote the use of up-to-date equipment and provide guidance on how to further reduce doses while maintaining image quality
- **Action 5:** Establish a dialogue with industry regarding improvement of radiological equipment, the use of up-to-date equipment and the harmonisation of exposure indicators
- **Action 6:** Organise radiation protection training courses and develop e-learning material to promote a safety culture and raise awareness of radiation protection
- **Action 7:** Collaborate with research platforms and other medical professions to develop a strategic research agenda for medical radiation protection
- **Action 8:** Develop data collection project "Is your imaging EuroSafe?" and educational project on guidelines "Are you imaging appropriately?"
- **Action 9:** Develop criteria for imaging procedures that use ionising radiation in specific exams and anatomical regions
- **Action 10:** Improve communication with health professionals through EuroSafe Imaging Steering Committee, website, newsletters, conferences, training material and social media
- **Action 11:** Improve information for and communication with patients regarding radiological procedures and related risks in order to ensure empowerment of patients
- **Action 12:** Engage with other stakeholders and collaboration with related initiatives and regulatory authorities in Europe and beyond to contribute to a global safety culture in medical imaging

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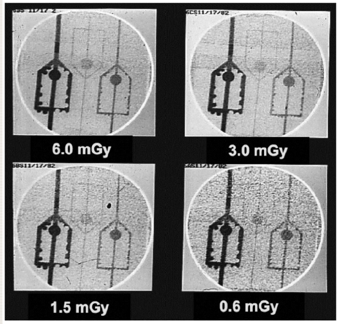
Medical Physicists

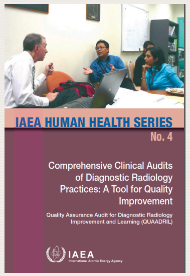
- Patient dosimetry
- Dose monitoring and audit
- Protocol optimization
- Image quality vs. dose

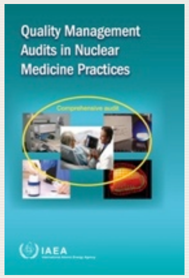


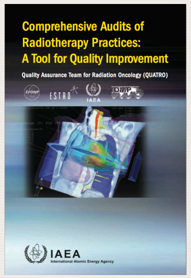
Radiological Technologists

- Dose delivery
- Co-operate with radiologists and physicists in optimization process
- Clinical protocol optimization – with radiologists
- Technical protocol settings – with physicists
- Utilize information from others to optimize the technical settings

IAEA Initiatives







Conclusion

- Why QA?
  - Enhance of patient care
- What we QA for?
  - Image quality
  - Patient safety
  - Cost-effective
- Role of the Profession?
  - Make sure QA program is in place
  - Run/perform QC activities
  - Image quality and patient safety in radiological practice

In Summary

- Diagnostic dose ranges between 0.2-20 mSv
- High dose procedures include interventional radiology and CT
- Dose optimization is needed to reduce stochastic risks of radiation
- Dose from investigations that reach deterministic threshold must be monitored
- Quality of care in radiology needs team works
- Justification and Optimization are the “MUST” for diagnostic radiology – this needs multi-disciplinary collaborative work

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References

- International Basic Safety Standards for Protection Against Ionizing Radiation and for the Safety of Radiation Sources. 115, Safety Standards. IAEA, 2011.
- United Nations Scientific Committee on the Effects of Atomic Radiation
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- Dosimetry in Diagnostic Radiology: An International Code of Practice Technical Reports Series No. 457, IAEA, 2007

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Thank You

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