Radiation Protection Issues for Fluoroscopist

Madan M Rehani, Ph.D.
International Atomic Energy Agency
M.Rehani@iaea.org
Interventional Fluoroscopist

No one else works so close to high radiation source
Interventional Fluoroscopy

• Radiotherapy- Staff works with shielded source or at shielded location
• Nuclear Medicine- Radiation intensity is much lower
• Radiology- Except interventional radiology, staff works at console
Cardiologists, EP, Vascular surgeons and Interventional Radiologists now lead the field in use of fluoroscopy.
## Interventional Cardiologists

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Is this 1st time you are attending a structured program on RP. Ans. Yes</td>
<td>88%</td>
<td>84%</td>
<td>93%</td>
<td>100%</td>
<td>93%</td>
</tr>
<tr>
<td>Any cardiologists conference you attended where there was lecture on RP. Ans. No</td>
<td>85%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Do you measure radiation dose to patient. Ans. No</td>
<td>96%</td>
<td>100%</td>
<td>87%</td>
<td>89%</td>
<td>71%</td>
</tr>
</tbody>
</table>

San Jose 2007 (11 countries of Latin-America)  
Yerevan 2008 (7 countries of Eastern Europe)  
Manila 2009 (8 countries)
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Is this 1st time you are attending a structured program on RP. Answer: Yes</td>
<td>100 %</td>
<td>100%</td>
<td>100%</td>
<td>95%</td>
</tr>
<tr>
<td>Any conference you attended where there was lecture on RP. Answer: No</td>
<td>100%</td>
<td>87%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Do you measure radiation dose to patient. Answer: No</td>
<td>100%</td>
<td>95%</td>
<td>89%</td>
<td>95%</td>
</tr>
<tr>
<td>Do you use badge to monitor your personal exposure. Answer: Yes</td>
<td>20%</td>
<td>9%</td>
<td>78%</td>
<td>47%</td>
</tr>
<tr>
<td>Was this course relevant to you (highly relevant)</td>
<td>100% (80%)</td>
<td>100 % (75%)</td>
<td>100 % (88%)</td>
<td>100 % (96%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Place</th>
<th>Participation of Doctor(s) from countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>Auckland, New Zealand</td>
<td>Bangladesh, China, India, Malaysia, Pakistan, Thailand, Vietnam</td>
</tr>
<tr>
<td>2007</td>
<td>Dubai, UAE</td>
<td>Bangladesh, Iran, Jordan, Lebanon, Mongolia, Pakistan, Sri Lanka, Thailand, Yemen, UAE</td>
</tr>
<tr>
<td>2008</td>
<td>Sofia, Bulgaria</td>
<td>Azerbaijan, Bosnia and Herzegovina, Croatia, Georgia, Kyrgyzstan, Lithuania, Poland, Bulgaria</td>
</tr>
<tr>
<td></td>
<td>Montevideo, Uruguay</td>
<td>Bolivia, Brazil, Chile, Costa Rica, Ecuador, El Salvador, Panama, Paraguay, Peru, Uruguay, Venezuela</td>
</tr>
</tbody>
</table>
Carry Home Points

1. Cardiologists, EP, Vascular surgeons and Interventional Radiologists now lead the field in use of fluoroscopy

2. Lack of: training, awareness, dose monitoring
Radiation injuries to patients in interventional procedures

- Severe injuries have occurred from the neck to the buttocks
- Sometimes anteriorly &
- On the side of torso

non-cardiac procedures
Almost a thing of past for staff in medical
154-kg patient presented at the Emergency Center
• prolonged rash 40 mm by 60 mm.
• The rash first appeared about six months prior; initially it was red and very itchy.

The dermatitis of unknown etiology was treated topically.
• With time the rash worsened.
• Further medical assistance was sought and was ineffective.
• The visit proved unsatisfactory in diagnosing the cause of the injury.
• Now, the patient presented at a different emergency center, desperate for help.
• The patient had about one month prior to the onset of the rash had undergone a complex coronary angioplasty and stent procedure that lasted, by the patient’s recollection, about six hours.
• The equipment used for the procedure was a state-of-the-art flat-panel digital angiography system.
• The patient had never been advised that the radiation received from that prolonged study could cause such an injury.
• Therefore, no reason to suspect that the treatment for his heart condition might have any significance.
• Classic case of radiation injury from fluoroscopically guided coronary intervention
A patient may get more radiation exposure in 5 CT scans than a staff working in X-ray department for full working life with adequate protection.
Thicker tissue masses absorb more radiation, thus much more radiation must be used to penetrate a large patient. Risk to skin is greater in larger patients!

[ESD = Entrance Skin Dose]
Slimness works, BUT when procedure is complex!!!!!!
Cases reported in one of IAEA’s projects - Japan

Courtesy Dr T Ishiguchi & Dr. K, Ohno
Carry Home Points

1. Cardiologists, EP, Vascular surgeons and Interventional Radiologists now lead the field in use of fluoroscopy
2. Lack of: training, awareness, dose monitoring
3. Skin injuries in absence of awareness
Role of equipment
SKIN INJURIES IN INTERVENTIONAL PROCEDURES

1. Skin injury in a patient with chronic total occlusion. a) 2 mths, b) 6 mths, c) 8 mths after last PCI, and d) after the flap surgery.
SKIN INJURIES IN INTERVENTIONAL PROCEDURES

Madan M. Rehani1,* and Suphot Srimahachota2
1Radiation Protection of Patients Unit, International Atomic Energy Agency, PO Box-100, A 1400 Vienna, Austria
2Division of Cardiology, Department of Medicine, King Chulalongkorn Memorial Hospital, Bangkok, Thailand

*Corresponding author: m.rehani@iaea.org; madan.rehani@gmail.com
Carry Home Points

1. Cardiologists, EP, Vascular surgeons and Interventional Radiologists now lead the field in use of fluoroscopy
2. Lack of: training, awareness, dose monitoring
3. Skin injuries in absence of awareness
4. Awareness includes being aware about equipment giving higher dose
Skin injuries reported

- Interventional cardiology
- Interventional radiology
- Electro-physiology
- Vascular surgery
- Orthopedic surgery, Urology, ....
Chairman: Madan Rehani
O. Ciraj-Bjelac, E. Vañó, D.L. Miller, S. Walsh, B.D. Giordano, J. Persliden,
<table>
<thead>
<tr>
<th>Procedure</th>
<th>Relative mean radiation dose to patient*</th>
<th>Reported values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 mSv 35</td>
<td>Fluoroscopy time (min)</td>
</tr>
<tr>
<td>EVAR</td>
<td></td>
<td>21</td>
</tr>
<tr>
<td>Venous access procedures</td>
<td></td>
<td>1.1-3.5</td>
</tr>
<tr>
<td>Renal/visceral angioplasty (stent/no stent)</td>
<td></td>
<td>20.4</td>
</tr>
<tr>
<td>Iliac angioplasty (stent/no stent)</td>
<td></td>
<td>14.9</td>
</tr>
</tbody>
</table>
Procedures with potential skin dose $> 1$ Gy

- Endovascular aneurysm repair (EVAR),
- Renal angioplasty, iliac angioplasty,
- Ureteric stent placement,
- Therapeutic ERCP
- Bile duct stenting and drainage
### Table 4.2. Typical patient dose levels (rounded) from Urological procedures.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Relative mean effective dose to patient</th>
<th>Relative mean radiation dose to patient*</th>
<th>Reported Fluoroscopy (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IVU/IVP</td>
<td>0</td>
<td>C,D</td>
<td>na**</td>
</tr>
<tr>
<td>Cystometrography</td>
<td></td>
<td>B</td>
<td>n</td>
</tr>
<tr>
<td>Cystography</td>
<td></td>
<td>C</td>
<td>n</td>
</tr>
<tr>
<td>Excretion urography/MCU</td>
<td></td>
<td>B</td>
<td>n</td>
</tr>
<tr>
<td>Urethrography</td>
<td></td>
<td>B</td>
<td>n</td>
</tr>
<tr>
<td>PCNL</td>
<td></td>
<td>A</td>
<td>6-12</td>
</tr>
<tr>
<td>Nephrostomy</td>
<td></td>
<td>D</td>
<td>1.3-20</td>
</tr>
<tr>
<td>ESWL</td>
<td></td>
<td>B</td>
<td>2.6-3.4</td>
</tr>
<tr>
<td>Kidney stent insertion</td>
<td></td>
<td>E</td>
<td>/</td>
</tr>
<tr>
<td>Ureteric stent placement</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 4.6. Typical patient dose levels (rounded) from gastroenterology and hepatobiliary procedures.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Relative mean effective dose to patient</th>
<th>Relative mean radiation dose to patient*</th>
<th>Reported Fluoroscopy (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERCP (diagnostic)</td>
<td></td>
<td>C,D</td>
<td>2-3</td>
</tr>
<tr>
<td>ERCP (therapeutic)</td>
<td></td>
<td>E,F</td>
<td>5-10</td>
</tr>
<tr>
<td>Biopsy</td>
<td></td>
<td>C</td>
<td>na**</td>
</tr>
<tr>
<td>Bile duct stenting</td>
<td></td>
<td>E</td>
<td>na**</td>
</tr>
<tr>
<td>PTC#</td>
<td></td>
<td>D</td>
<td>6-14</td>
</tr>
<tr>
<td>Bile duct drainage</td>
<td></td>
<td>F,G</td>
<td>12-26</td>
</tr>
<tr>
<td>TIPS***</td>
<td></td>
<td>F,G</td>
<td>15-93</td>
</tr>
<tr>
<td>Transjugular hepatic biopsy</td>
<td></td>
<td>D</td>
<td>6.8</td>
</tr>
</tbody>
</table>

* A=≤1 mSv; B=1 to <2 mSv; C=2 to <5 mSv; D=5 to <10 mSv; E=10 to <20; F=20 to 35 mSv
** not available
### Table 4.4. Typical patient dose levels (rounded) from various orthopaedic procedures.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Relative mean dose to patient</th>
<th>Relative mean radiation dose to patient*</th>
<th>Reported values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skull</td>
<td>A</td>
<td>A</td>
<td>na**</td>
</tr>
<tr>
<td>Cervical Spine</td>
<td>A</td>
<td>B</td>
<td>0.2-0.8</td>
</tr>
<tr>
<td>Thoracic Spine</td>
<td>B</td>
<td>B</td>
<td>0.85</td>
</tr>
<tr>
<td>Lumbar Spine</td>
<td>B</td>
<td>B</td>
<td>0.10-1.4</td>
</tr>
<tr>
<td>Pelvis</td>
<td>A</td>
<td>A</td>
<td>na**</td>
</tr>
<tr>
<td>Hip</td>
<td>A</td>
<td>A</td>
<td>0.020-1.15</td>
</tr>
<tr>
<td>Shoulder</td>
<td>A</td>
<td>A</td>
<td>na**</td>
</tr>
<tr>
<td>Knee</td>
<td>A</td>
<td>A</td>
<td>na**</td>
</tr>
<tr>
<td>Other extremities</td>
<td>A</td>
<td>A</td>
<td>na**</td>
</tr>
<tr>
<td>Hand/wrist</td>
<td>B,C</td>
<td>B,C</td>
<td>0.20-0.55</td>
</tr>
<tr>
<td>Distal radius plate osteosynthesis</td>
<td>na**</td>
<td>na**</td>
<td>1.8***</td>
</tr>
<tr>
<td>Osteosynthesis of malleolar fracture</td>
<td>na**</td>
<td>na**</td>
<td>1.5***</td>
</tr>
<tr>
<td>Plate osteosynthesis of tibial plateau fracture</td>
<td>na**</td>
<td>na**</td>
<td>1.2***</td>
</tr>
<tr>
<td>Arthroscopy for ACL reconstruction</td>
<td>na**</td>
<td>na**</td>
<td>0.9***</td>
</tr>
<tr>
<td>Tibial intramedullary nailing</td>
<td>na**</td>
<td>na**</td>
<td>5.7***</td>
</tr>
<tr>
<td>Intramedullary nailing of diaphyseal femoral fracture</td>
<td>na**</td>
<td>na**</td>
<td>6.3***</td>
</tr>
</tbody>
</table>
Annals of ICRP

• Radiological Protection in Cardiology – Likely to be published by Q3 2012
Other Specialities & Imaging Modalities

- PET/CT Scanning
- Dental Radiology - X rays
- Dual Energy X ray Absorptiometry - Bone Mineral Densitometry
- Gastroenterology
- Orthopedic surgery
- Urology
- Referring Medical Practitioners
- Anaesthesiology
Interventional Cardiology

Erythema

Different phases of erythema evolution

Cardiologists are among the most intensive users of fluoroscopy in the medical profession, if not the most frequent. However, many of them are unaware that they may be exposing patients to relatively high levels of radiation during cardiac catheterization procedures - levels much higher than those handled by many radiologists. While staff protection is definitely important, there are bigger issues of patient protection in interventional procedures using X rays. For description of radiation units and dose quantities, please click here.

Patient protection

1. Are radiation induced skin injuries common among patients undergoing interventions?
2. What problems are associated with diagnosis of such injuries?
3. Can radiation injuries be prevented?
4. How high is the exposure in cardiac interventions in comparison to chest radiograph?
5. Which factors can affect patient dose in cardiac interventions?
6. How can I manage patient exposure?
7. What adverse effects could occur as a result of dose reduction actions?

Staff protection - Some of the measures to reduce patient dose will also result in a reduction of staff dose
Staff protection - Some of the measures to reduce patient dose will also result in a reduction of staff dose

8. Is the exposure to the cardiologist much higher than to non-interventionalists?
9. Is there a risk of cataract after several years of work in a catheterization laboratory?
10. Can I work my full professional life in a catheterization laboratory and have no radiation effects?
11. What are the typical radiation doses associated with diagnostic and therapeutic interventional procedures?

1. Are radiation induced skin injuries common among patients undergoing interventions?

No. Radiation induced skin injuries happen very rarely and the rough estimate is around one in 10,000 interventions. This figure can vary by a large margin as many injuries go unreported. The skin injuries can vary from mild redness to severe skin ulceration.

Asian Network of Cardiologists in Radiation Protection

The IAEA in 2007 established an Asian network of cardiologists in radiation protection through its project under Regional Cooperative Agreement for Asia and the Pacific (RCA) which has 17 Member States (Australia, Bangladesh, China, India, Indonesia, Japan, Republic of Korea, Malaysia, Mongolia, Myanmar, New Zealand, Pakistan, Philippines, Singapore, Sri Lanka, Thailand and Vietnam). The network started with interventional cardiologists who have undergone IAEA training as founding members. The network is coordinated by the IAEA staff. The first and foremost action taken by the network was to launch a newsletter, which by known accounts is the very first newsletter on radiation protection in cardiology of any cardiology organization. The members of the network are active in disseminating the knowledge on radiation protection.
Interventional Cardiology
rpop.iea.org/rpop/rpop/.../5_interventionalcardiology/index.htm
Jump to What are the typical radiation doses associated with diagnosis and... KUON, E., et al., Radiation-reducing planning of cardiac ...

Radiation Protection in Cardiology
www.iea.org/newscenter/focus/radiationprotection/cardiology.p
Lecture 3: What Radiation Effects are Possible? 2. IAEA. Radiation Protection in Cardiology. Answer True or False. 1. It is accepted that the stochastic dose response relationship for radiation effects applies to biological systems in general ...

The IAEA establishes a network of gastroenterologists in radiation ...
rpop.iea.org/RPOP/RPoP/Content/.../network-gastroenterologists.htm...
As announced last month, a network of gastroenterologists in radiation protection was established by the IAEA during a meeting held in Montevideo, Uruguay, ...

From the Editor's Desk
rpop.iea.org/RPOP/RPoP/Content/.../gastro-newsletter-issue1.pdf
Lecture 3: What Radiation Effects are Possible? 2. IAEA. Radiation Protection in Cardiology. Answer True or False. 1. It is accepted that the stochastic dose response relationship for radiation effects applies to biological systems in general ...

Gastroenterology
rpop.iea.org/RPOP/RPoP/Content/.../gastroenterology/index.htm
Radiation Protection in Gastroenterology. The use of ionizing radiation in gastroenterology is somewhat in transition. In the past, gastroenterologists performed a ...

The IAEA to establish a network of Gastroenterologists in Radiatio...
rpop.iea.org/.../network-gastroenterologists-radiation-protection.htm
Gastroenterologists from 10 Latin American countries to meet on 8-10 April to form a network.
Urology
rpop.iaea.org/RPOP/RPoP/Content/.../Urology/index.htm
by P Top - Related articles
Jump to What is the major cause of radiation exposure to personnel ... major source of radiation exposure to personnel in fluoroscopy ...

Radiation Protection in Urology - The Society of Radiologists
www.soradtt.com/sub.php?content=newsDetail&id=63
This update is centered on Radiation Protection in Urology and ... in the field need to pay attention to during these procedures. The IAEA ...

Radiation Protection - Construction of radiation bunkers.
www.pravida.de/Radiation-bunker
The expert in design & construction

Orthopedic surgery
rpop.iaea.org/RPOP/RPoP/Content/.../Orthopedic/index.htm
by P Top - Related articles
Jump to Can I work my full professional life with radiation in the operating ... There are situations where protection ... What are the typical radiation doses associated with orthopaedic procedures ... Used in Orthopaedic Surgery.

[PPT] Slide 1 - RPoP - IAEA
https://rpop.iaea.org/.../NCNR-L06A-Radiation-protection-for-patient...
File Format: Microsoft Powerpoint - Quick View
Orthopaedic Surgeons; Anesthetists; Operating room personnel. IAEA Training Course on Radiation Protection for Doctors (non-radiologists, non-cardiologists) ...

[PDF] Staff Dose in Orthopedic
www.oramed-fp7.eu/en/-/media/Files/ORAMED/.../34HOSMAN.ash...
File Format: PDF/Adobe Acrobat
Orthopaedic surgeon use c-arm machine: either conventional or mini C-arm. International Workshop On Radiation Protection of Medical Staff (ORAMED) 20-22 ...

ISRRT - "Radiation protection website IAEA"
New training material on radiation protection for Doctors using fluoroscopy outside medical centers. Orieantation of Radiation Protection of Medical Staff (ORAMED) 20-22 ...
Carry Home Points

1. Cardiologists, EP, Vascular surgeons and Interventional Radiologists now lead the field in use of fluoroscopy

2. Lack of: training, awareness, dose monitoring

3. Skin injuries in absence of awareness

4. Awareness includes being aware about equipment giving higher dose

5. ICRP Publications & IAEA Website
<table>
<thead>
<tr>
<th>Language</th>
<th>Patient</th>
<th>Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>10 pearls on radiation protection of <strong>patients</strong> in fluoroscopy</td>
<td>10 pearls on radiation protection of <strong>staff</strong> in fluoroscopy</td>
</tr>
<tr>
<td></td>
<td>Download PDF</td>
<td>Download PDF</td>
</tr>
<tr>
<td>Ελληνικά</td>
<td>10 χρυσοί κανόνες: Ακτινοπροστασία ασθενών κατά την ακτινοσκόπηση Λήψη αρχείου PDF</td>
<td>10 χρυσοί κανόνες: Ακτινοπροστασία προσωπικού κατά την ακτινοσκόπηση Λήψη αρχείου PDF</td>
</tr>
<tr>
<td>Македонски</td>
<td>10 Златни правила: Заштита на пациентите од радијација при флуороскопија превземете PDF</td>
<td>10 Златни правила: Заштита од радијација на персоналот при флуороскопија превземете PDF</td>
</tr>
<tr>
<td>Русский</td>
<td>10 Способов радиационной защиты пациентов скачать PDF</td>
<td>10 Способов радиационной защиты персонала скачать PDF</td>
</tr>
</tbody>
</table>
10 Pearls: Radiation protection of patients in fluoroscopy

1. Maximize distance between the X ray tube and the patient to the extent possible

![Diagram showing distance between X ray tube and patient]

6. Larger patients or thicker body parts trigger an increase in entrance surface dose (ESD)

- ESD: 1 unit
- 2-3 units
- 4-6 units
- 8-12 units

7. Oblique projections also increase ESD
   Be aware that increased ESD increases the probability of skin injury
   \[ h_1 < h_2 < h_3 \]

3. Minimize fluoroscopy time
   Keep records of fluoroscopy time for every patient

4. Use pulsed fluoroscopy with the lowest frame rate possible to obtain images of acceptable quality

5. Avoid exposing the same area of the skin in different projections
   Vary the beam entrance port by rotating the tube around the patient

8. Avoid the use of magnification
   Decreasing the field of view by a factor of two increases dose rate by a factor of four

9. Minimize number of frames and cine runs to clinically acceptable level
   Avoid using the acquisition mode for fluoroscopy

10. Use collimation
    Collimate the X ray beam to the area of interest

Related Poster:
10 Pearls: Radiation protection of patients in fluoroscopy
http://ropop.iaea.org

IAEA
Atoms for Peace: The First Half Century
1957–2007
10 Pearls: Radiation protection of staff in fluoroscopy
Reducing patient dose always results in staff dose reduction

1. Use protective devices!
- Advisable skirt type lead apron to distribute weight
- 0.25 mm lead equivalence but with overlap on front to make it 0.5 mm on the front and 0.25 mm on the back (Provides >90% protection)
- Lead glass eyewear with side protection
- Thyroid protection

2. Make good use of time-distance-shielding (TDS) principle
- Minimize time
- Maximize distance as much as clinically possible

3. Use ceiling suspended screens, lateral shields and table curtains
- They provide more than 90% protection from scattered radiation in fluoroscopy
- Mobile floor shielding is advisable when using cine acquisition

4. Keep hands outside the primary beam unless totally unavoidable
- Hands inside the central area of the primary beam will increase exposure factors (kV, mA) and doses to patient and staff

5. Only 1-5% of radiation falling on the patient's body exits the other side
- Stand on the side of the transmitted beam (i.e., by the detector), which contains only 1-5% of the incident radiation and its respective scatter

6. Keep X ray tube under the patient table and not over it
- Undercouch systems provide better protection from scattered dose

7. Use personal dosimetry
- Use at least two dosimeters
  - One inside the apron at chest level
  - One outside the apron at neck or eye level
- Additional finger ring dosimeter for procedures requiring hands close to primary beam
- Real time dosimetry systems are useful

8. Update your knowledge about radiation protection

9. Address your concerns about radiation protection to radiation protection specialists (medical physicists)
- Quality control testing of fluoroscopy equipment enables safe and stable performance
- Know your equipment! Using the equipment's features appropriately will help reduce doses to patients and staff

10. REMEMBER!
- Use injector devices

IAEA
Atoms for Peace: The First Half Century
1957-2007
Carry Home Points

1. Cardiologists, EP, Vascular surgeons and Interventional Radiologists now lead the field in use of fluoroscopy
2. Lack of: training, awareness, dose monitoring
3. Skin injuries in absence of awareness
4. Awareness includes being aware about equipment giving higher dose
5. ICRP Publications & IAEA Website
6. Posters from IAEA website
Requesting your help please!

*I have a chronic radiation burn which has been ulcerated for months! (Pathology report)*

**Causes:**
- Angioplasty procedure that lasted 3.5 hours, 2 stents placed in lad which was 100% blocked.
- Couple of weeks later the burn came out on by left lower back about the size of a deck of cards.
- Procedure was done by cardiologist on Jan. 31, 2008

I have been suffering with this for 9 months and still it does not seem this is going to heal. It has shrunk but is not relieving me in pain.

**Issues:**
- I have been to my cardiologist, 2 dermatologists none of which had ever seen or knew how to treat this burn.
- I am now at a plastic surgeon
From: Louis K Wagner [mailto:Louis.K.Wagner@uth.tmc.edu]
   Sent: Friday, 24 June 2005 15:56
   To: REHANI, Madan Mohan
   Subject: Vienna conference

I just received an e-mail from a patient in the US who underwent angioplasty and developed an ulcerating injury. The patient’s physician misdiagnosed the injury as a staph infection. When the wound worsened she went to the ER and the ER physician diagnosed it as a burn of unknown origin. The patient then went to the web and found reports on our meeting in Vienna last year. On the basis of the descriptions of the injuries and their progression she was able to diagnose the etiology as due to her angioplasty. Neither her cardiologist nor the radiologists at the hospital were aware that such a thing could occur and were surprised when she brought the evidence to them. This was an interesting case report that shows that our message is slowly getting broader exposure. Unfortunately, the patients seem to be the ones who are teaching the physicians.

---lkw

Louis K. Wagner, Ph.D., FACR, FAAPM
The University of Texas Medical School at Houston
this situation
Safety in Radiological procedures

The IAEA has a sub-programme on Radiation Protection of Patients that operates under an International Action Plan. This is the first ever programme dedicated to radiation protection of patients started in 2001 by an international organization. A dedicated website was established in 2006 that is becoming a popular resource for credible information for health professionals, patients and public.

The website provides information on radiation safety in interventional procedures besides other areas in radiology, radiotherapy, nuclear medicine, dental radiology, pregnancy and for children. Also training material has been provided for free download for use by health professionals.

SAFRAD (SAFety in RADiological procedures) is a voluntary reporting system where patients submitted to defined trigger levels or events in fluoroscopically-guided interventional procedures are included in an international database. The primary objective of the system is educational in nature. It is believed that going through the process of SAFRAD itself results in safety. For more information about SAFRAD, click here.
SAFRAD TRIGGERS

Trigger values

1. Fluoroscopy time (FT) > 40 min
2. KAP (or DAP) values > 200 Gy.cm^2 or 20000 cGy.cm^2 or 20000 mGy.m^2 or 200000 mGy.cm^2
3. Cumulative Dose (CAK) > 5 Gy
4. Peak skin dose (PSD) > 2 Gy
5. Number of series (NS) > 20

Trigger events

6. Wrong patient
7. Wrong procedure
8. Unknown pregnancy of patient
9. Multiple procedures within 1 months (MP)
Background on Radiation Injury in Cardiology

The health risks:

• **Serious radiation skin injuries have occurred in a very small percentage** of patients (say 1 in 10,000).

• **Younger patients face an increased risk of induced cancer** (usually <<1% incidence).
Carry Home Points

1. Cardiologists, EP, Vascular surgeons and Interventional Radiologists now lead the field in use of fluoroscopy

2. Lack of: training, awareness, dose monitoring

3. Skin injuries in absence of awareness

4. Awareness includes being aware about equipment giving higher dose

5. ICRP Publications & IAEA Website

6. Posters from IAEA website

7. International voluntary reporting system SAFRAD
Everything you do for patient protection has impact on staff protection too, BUT reverse is not true.
Thank You