RADIATION PROTECTION OF PATIENTS UNDERGOING INTERVENTIONAL CARDIOLOGICAL PROCEDURES

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named after professor P.V. Ramzaev

Laboratory of radiation protection from medical exposure
- Nuclear medicine
- Conventional radiology
- Interventional radiology
- Computer Tomography

Medical Physicist?
Objectives:
To determine the main sources of differences in dose levels in interventional cardiology in SPb and to evaluate the DRL

Under investigation during 2010-2012:

7 clinics of St-Petersburg
more than 500 cardio examinations

Collected parameters
• Dosimetric parameters
• Technical parameters
• Geometrical parameters
Range of individual dose (all examinations from 7 clinics)

\[ E_{\text{eff}}, \text{mSv} \]

- **Diagnostic**
  - Max: 98 mSv
  - Min: 3 mSv
  - Mean (Median): 15 (13) mSv

- **Therapeutic**
  - Max: 164 mSv
  - Min: 3 mSv
  - Mean (Median): 29 (26) mSv

UNSCEAR Report 2008

Interventional cardiology

diagnostic
- 2 - 16 mSv

therapeutic
- 5 - 41 mSv
Median values of DAP

![Bar graph showing median values of DAP in operating rooms 1 to 8. The x-axis represents operating rooms, and the y-axis represents DAP in cGy*cm². The graph compares diagnostic and therapeutic procedures.](image-url)
The factors influencing the levels of exposure of patients in IR

- parameters of angiography equipment
- procedures protocol
- anatomy of the patients
- location of the lesion
- complexity of the procedure
- skill and experience of interventionalist
# The parameters of angiography equipment

<table>
<thead>
<tr>
<th>Angiography unit</th>
<th>Most usable Field of View on II, cm (range)</th>
<th>Estimated mean values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Fluoro dose rate*, mGy/min</td>
</tr>
<tr>
<td>1</td>
<td>17 (17-38)</td>
<td>~70</td>
</tr>
<tr>
<td>2</td>
<td>16 (12-30)</td>
<td>30-40</td>
</tr>
<tr>
<td>3</td>
<td>16 (11-32)</td>
<td>20-30</td>
</tr>
<tr>
<td>4</td>
<td>17 (17-38)</td>
<td>~70</td>
</tr>
<tr>
<td>5</td>
<td>16 (12-30)</td>
<td>20-30</td>
</tr>
<tr>
<td>6</td>
<td>17 (13-33)</td>
<td>30-40</td>
</tr>
<tr>
<td>7</td>
<td>16 (11-32)</td>
<td>20-40</td>
</tr>
<tr>
<td>8</td>
<td>16 (12-30)</td>
<td>30-40</td>
</tr>
</tbody>
</table>

* - measured by build-in ionization chamber
(usable parameters for coronaroangiography)
The procedures protocol

**Fluoro time**

<table>
<thead>
<tr>
<th>Operating room</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnostic</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
</tr>
<tr>
<td>Therapeutic</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
</tbody>
</table>

**Number of frames**

<table>
<thead>
<tr>
<th>Operating room</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnostic</td>
<td>2000</td>
<td>2500</td>
<td>3000</td>
<td>500</td>
<td>1000</td>
<td>1500</td>
<td>2000</td>
<td>2500</td>
</tr>
<tr>
<td>Therapeutic</td>
<td>1500</td>
<td>2000</td>
<td>2500</td>
<td>3000</td>
<td>5000</td>
<td>1000</td>
<td>1500</td>
<td>2000</td>
</tr>
</tbody>
</table>

* - median values
**Diagnostic Reference Level**

**DRL for IR:**
75\textsuperscript{th} percentile of the distribution of large number of cases for a specific procedures from each facility

(Report 168 NCRP)

<table>
<thead>
<tr>
<th>Type of examination</th>
<th>DAP(Gy·cm(^2))</th>
<th>T fluoro (min)</th>
<th>N frames (pcs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coronarography (this study)</td>
<td>97</td>
<td>8</td>
<td>1400</td>
</tr>
<tr>
<td>Coronarography (Report 59 IAEA)</td>
<td>50</td>
<td>9</td>
<td>1000</td>
</tr>
<tr>
<td>Coronaroplasty (this study)</td>
<td>170</td>
<td>18</td>
<td>2100</td>
</tr>
<tr>
<td>Coronaroplasty (Report 59 IAEA)</td>
<td>125</td>
<td>22</td>
<td>1700</td>
</tr>
</tbody>
</table>

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Svetlana Sarycheva

10.11.2010
Recommendations

1. It is recommended to use a special cardiology equipment (with small FOV) for coronary procedures.

2. Frame rate in radiography mode during coronary examination (of adult patient) should not exceed 12.5-15 fps.

3. It is necessary to use the equipment’s features which allow to reduce the dose levels.

4. The training for medical staff about the basic principles of radiation protection is required.

5. It is recommended to establish the DRL like one of the most effective tools for the optimization of radiation protection of patients.
Thank you!