Radiation Exposure to Patients and Radiologists during Interventional Procedures

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Introduction - Purpose

Interventional radiology is a fast growing area for the examination and repairing patients’ problems. Angiographies and angioplasties were performed at a mean annual number of 1800 during the last decade at AXEPA hospital.

Patients who undergo these interventional radiological examinations and the medical doctors who perform them receive a noticeable radiation dose. Thus, the optimization of the technique and the estimation of effective doses is essential.
Materials and Methods

26 angiographies and 6 angioplasties performed by 4 doctors were included in this study. They were classified as examinations of:

- lower limbs
- abdominal aorta
- aortic arch/carotid artery
Materials and Methods

- TLD sensitive dosimeters, namely LiF: Mg, Cu, P, were placed underneath and over the lead apron of the doctors at all the 32 examinations.
- TLD dosimeters were also placed next to the eyes and over the thyroid of 22 patients.
- DAP values, time duration and other parameters were also registered.
Materials and Methods

Patients’ effective dose, ED, and doses to the various organs were calculated with the aid of WIN ODS-60 software.

The effective doses were normalized to DAP measured in each procedure and the ED/DAP index was calculated.

Based on TLD measurements, the Niklason method was applied for the calculation of doctors’ ED.
## Results - 1

<table>
<thead>
<tr>
<th>Examination</th>
<th>DAP (cGy.cm²)</th>
<th>ED (mSv)</th>
<th>CF (mSv/cGy.cm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Range median</td>
<td>Range median</td>
<td></td>
</tr>
<tr>
<td>Lower limbs</td>
<td>25-8728</td>
<td>0,00 - 1,46</td>
<td>0,0002</td>
</tr>
<tr>
<td></td>
<td>4207</td>
<td>1,00</td>
<td></td>
</tr>
<tr>
<td>Abdominal aorta</td>
<td>22325-31763</td>
<td>2,63 - 49,32</td>
<td>0,0031</td>
</tr>
<tr>
<td></td>
<td>25531</td>
<td>19,29</td>
<td></td>
</tr>
<tr>
<td>Aortic arch / Carotid artery</td>
<td>1709-24013</td>
<td>0,07 - 45,12</td>
<td>0,0011</td>
</tr>
<tr>
<td></td>
<td>10563</td>
<td>10,10</td>
<td></td>
</tr>
</tbody>
</table>
Results - 2

Correlation between patients’ eye dose measured with TLD and WIN ODS-60 software

Correlation between patients’ thyroid dose measured with TLD and WIN ODS-60 software

\[ y = 0.894x \]
\[ R^2 = 0.9919 \]

\[ y = 0.773x \]
\[ R^2 = 0.9931 \]
Results - 3

Effective dose of radiologist A and B in relation with total DAP

\[ y = 0.0592e^{0.0003x} \]

\[ y = 0.0425e^{0.0002x} \]

* Total number of procedures during 2009:

angiographies 1601
angioplasties 230
The exposure of the radiologists varied depending on the x-ray parameters, the type and the complexity of the procedure, their position relative to the radiation field and their experience.

Taking into consideration the annual number of examinations performed in the department, the estimated dose to the eyes surpasses the annual limit for population, so wearing protective glasses is recommended.
Conclusion - 2

- TLD can be reliably used for the estimation of absorbed doses of superficial organs (eyes, thyroid).
- Patients receive considerable dose depending on the organs in the radiation fields, the duration and the ratio of fluro/cine exposure.
- Skin dose did not exceed the limit of 2 Gy, cutoff value for erythema.