Patient Radiation Doses from Radiographic Examinations in Korea

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Background

Radiation Exposure from Medical Imaging:
Medical imaging results in radiation exposure and thus potentially negative health effects such as cancer.

Rapid Increase of Medical Exposure:
According to a recent NCRP report, increasing use of medical radiation contributed to half of total exposure to the US population. The US population.

Justification and Optimization of Medical Exposure:
By adjusting technical parameters of x-ray machine, radiation dose to patients can be minimized without detriment to the clinical purpose.

DRL (Diagnostic Reference Level):
There are significant variations in national practice with medical imaging and radiation exposure to patients. Whether patient exposure is unusually high, DRL can effectively minimize radiation exposure to patients.

Objectives

To measure radiation doses to patients from radiographic examinations
To collect information associated with patient dose

Materials and Methods

Number of Hospitals: 320 Hospitals in 3 Provinces

Dose Measurements

- Rando and PMMA phantoms were exposed under typical x-ray technical settings (e.g., kVp, mAs, etc.).
- Entrance surface dose (ESD) was measured using glass dosimeters placed on the phantom.

Examination Types

Conventional Radiography:
(1) Skull AP
(2) Skull LAT
(3) Chest PA
(4) Chest AP
(5) Chest LAT
(6) Abdomen AP
(7) Pelvis AP
(8) C-spine AP
(9) C-spine LAT
(10) T-spine AP
(11) T-spine LAT
(12) L-spine AP
(13) L-spine LAT
(14) L-spine OB
(15) Clavicles AP
(16) Shoulder AP
(17) Humerus AP
(18) Elbow AP
(19) Wrist AP
(20) Hip AP
(21) Knee AP
(22) Ankle AP

Mean radiation dose varied with exam types:
- ESD: 0.2 (Wrist AP) ~ 8.8 (L-spine LAT) mGy
- High dose group: L-spine, T-spine
- Median dose group: pelvis, abdomen, hip, skull, cervical spine, clavicle, shoulder, and chest
- Low dose group: extremity

Collection of Information Associated with Patient Dose

- Checklist was developed to collect the information.
- Information on x-ray equipments, operation settings, dose reduction techniques.

Mean radiation dose from radiographic examinations:
- Wide variation among hospitals for the same type of examination.
- Mean mAs: 5.7 (Wrist) ~ 51 (L-spine LAT) mAs

Table 1. Technical settings and radiation doses from radiographic examinations

<table>
<thead>
<tr>
<th>Examination Type</th>
<th>Voltage (kVp)</th>
<th>Current-time (mA)</th>
<th>ESD (mgY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skull (AP)</td>
<td>74 (±6)</td>
<td>23 (±10)</td>
<td>2.3 (0.2-8.6)</td>
</tr>
<tr>
<td>Skull (LAT)</td>
<td>74 (±7)</td>
<td>23 (±13)</td>
<td>2.5 (0.1-11)</td>
</tr>
<tr>
<td>Chest (PA)</td>
<td>100 (±19)</td>
<td>10 (±9)</td>
<td>0.5 (0.1-2.6)</td>
</tr>
<tr>
<td>Chest (AP)</td>
<td>86 (±17)</td>
<td>10 (±8)</td>
<td>1.4 (0.1-6.2)</td>
</tr>
<tr>
<td>Chest (LAT)</td>
<td>97 (±18)</td>
<td>25 (±21)</td>
<td>2.6 (0.1-23)</td>
</tr>
<tr>
<td>Abdomen(AP)</td>
<td>77 (±7)</td>
<td>28 (±15)</td>
<td>3.1 (0.3-14)</td>
</tr>
<tr>
<td>Pelvis (AP)</td>
<td>76 (±7)</td>
<td>28 (±13)</td>
<td>3.1 (0.3-10)</td>
</tr>
<tr>
<td>T-Spine (AP)</td>
<td>76 (±7)</td>
<td>29 (±16)</td>
<td>3.2 (0.3-12)</td>
</tr>
<tr>
<td>T-Spine (LAT)</td>
<td>83 (±11)</td>
<td>41 (±23)</td>
<td>6.8 (0.3-34)</td>
</tr>
<tr>
<td>L-Spine (AP)</td>
<td>79 (±7)</td>
<td>32 (±16)</td>
<td>3.8 (0.3-18)</td>
</tr>
<tr>
<td>L-Spine (LAT)</td>
<td>86 (±8)</td>
<td>51 (±31)</td>
<td>8.8 (0.1-50)</td>
</tr>
<tr>
<td>L-Spine (OBL)</td>
<td>83 (±8)</td>
<td>51 (±20)</td>
<td>5.2 (0.1-24)</td>
</tr>
</tbody>
</table>

Results and Discussion

Information associated with patient dose
- Tube Voltage
  - Relatively less variation among hospitals
  - Mean kVp: 51 (Wrist) – 100 (Chest PA) kVp, Mostly 80 kVp

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