Paediatric Imaging Working Group

Paediatric DRLs made easy

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Introduction

- Establishing quantitative indicators on the value of administered doses allows the comparison between different examination techniques to promote strategies for optimizing patient protection;

- The pediatric DRL’s are expected not to be exceeded in the routine procedures when good diagnostic quality practices are applied.
Diagnostic Reference Levels/ICRP

Advisory dose levels to help in optimisation of imaging practices

Aim to identify unusually high dose levels

Defined for common examinations e.g. chest radiography, pelvis radiography
Diagnostic Reference Levels/ICRP

Defined for examinations with potentially high patient exposure, e.g. CT, fluoroscopy (especially IR)

Should always be considered keeping in mind the balance between the diagnostic value of the medical imaging task (Image quality should not be higher than required for diagnostic purposes)
DRLs are NOT

- Dose restrictions or limits

DRL’s are guiding levels for optimised practices, established for groups of patients, not individual patients.

- To separate good and bad practices
Reasons to compare your dose levels to DRLs

To optimise imaging protocols
- new equipment
- any change in imaging practice
- need for further optimisation

To know where we stand with our dose levels
- curiosity
- proof of the level of dose optimisation/radiation protection practices

As a part of regular audit/self assessment/quality assessment
- Verify the exposure parameters and the image quality

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DRLs to use

- National DRLs
  - set by national authoritative bodies
  - based on national dose collections

- European DRLs (PiDRL)
  - if national DRLs do not exist
  - based on existing national DRLs in Europe

- Local DRLs
  - based on local/areal dose collections without official involvement of national authoritative body
  - should be considered especially in big units with modern equipment or if the national DRLs are outdated
Child specifics in the use of DRLs

- Patient size has to be accounted for
  - weight is recommended by EC and ICRP
  - if age is used, the number of patients should be considerably higher
  - PiDRL report includes conversion tables for age groups - weight groups
- DRLs are usually given for specific weight groups
  (or as a continuous curve: Finland)
- There is variation of the use of 32 cm or 16 cm phantom for the calculation of dose quantities in paediatric body protocols
Paediatric categorisation

✓ Rare publications quoting patient age + weight;
✓ Only a few with patient weight;
✓ The majority used patient age;
✓ Most common appears to be:

<1
1-5
5-10
10-15 y.o.

Järvinen et al., 2011, 2014
Roch & Aubert, 2013
Categorisation recommendations

**Body examinations**
- < 5 kg
- 5 - < 15 kg
- 15 - < 30 kg
- 30 - < 50 kg
- 50 - < 80 kg

**Head CT examinations**
- 0 - < 4 weeks
- 4 weeks - < 1 year
- 1 - < 6 years
- ≥ 6 years

-European Guidelines on DRLs for Paediatric Imaging-
Final complete draft for PiDRL Workshop
30 September 2015
### Age equivalent group

<table>
<thead>
<tr>
<th>Description</th>
<th>Weight group</th>
<th>Age group based on charts</th>
<th>Most common age on NDRLs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neonate</td>
<td>&lt; 5 kg</td>
<td>&lt; 1 m</td>
<td>0 y</td>
</tr>
<tr>
<td>Infant, toddler and early childhood</td>
<td>5 -&lt; 15 kg</td>
<td>1 m - &lt; 4 y</td>
<td>1 y</td>
</tr>
<tr>
<td>Middle Childhood</td>
<td>15-&lt; 30 kg</td>
<td>4 y - &lt; 10 y</td>
<td>5 y</td>
</tr>
<tr>
<td>Early adolescence</td>
<td>30-&lt;50 kg</td>
<td>10 y - &lt; 14 y</td>
<td>10 y</td>
</tr>
<tr>
<td>Late adolescence</td>
<td>50-&lt;80 kg</td>
<td>14 y - &lt; 18 y</td>
<td>15 y</td>
</tr>
</tbody>
</table>
How to collect the doses for comparison

- Design an easy form/table for dose collections and make sure every user understands it.
- Collect dose values from every room/equipment separately.
- Record dose quantities as they appear on your console. They can be converted later to the quantity used in DRLs (Any conversion of quantities in between the daily practice is a sure source of mistakes).
- Collect dose values from minimum of 10 patients for each weight group.
How to compare own dose level to the DRLs

1. Convert your dose values to the one used in the DRLs
2. Calculate the median of your own dose values for each weight group
3. Compare the median dose for each group to the given DRL
How to read the result

- If your median dose is higher than the DRL, the DRL is exceeded

- Analysis of the reasons
  - survey methodology
  - equipment performance
  - protocol design
  - operator performance (right protocol for the right patient/indication)

- Consider corrective actions to improve the practice
  - protocol optimisation
  - operator education
  - equipment QC
Conclusions

- Analyse the results of dose collections and take actions, if needed!
- DRL’s are a practical tool to promote optimisation.
- Optimisation of patient protection in radiology requires application of specific imaging protocols adapted to the age, volume, anatomic region and clinical indication, in order to ensure that patient doses are as low as reasonably possible for the imaging task.
References


• Medina LS, et all Evidence-Based Imaging in Pediatrics: Optimizing Imaging in Pediatrics. Springer. 2010

• G. Paulo et al. 2016 Analysis of overexposed areas in paediatric plain radiography, ECR 2016