Children and radiation in medicine – protecting the young patients

„European scenario and actions needed“

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IAEA – General Conference, September 2011

Dep. of Radiology

Div. of Pediatric Radiology
Main international pediatric radiology scientific societies

- ESPR
- SPR (USA/Canada)
- SLARP (South Americas)
- AOSPR (Asian & Oceanic)
World Federation of Paediatric Imaging (WFPI)

mission statement

The WFPI provides a voice for Paediatric Radiology organizations united to address challenges in global paediatric imaging, including the allocation of resources, promoting education, and advocating appropriate imaging guidelines to benefit children worldwide.
World Federation of Paediatric Imaging (WFPI)

goals

• to promote the standards in and the status of paediatric imaging and radiation protection for children worldwide.

• to influence the standards of education in training within paediatric imaging, and disseminate best practices, notably in low resources setting.
World Federation of Paediatric Imaging (WFPI)

goals

• to promote and encourage paediatric imaging research and share experiences globally.

• to foster opportunities for communication and collaboration between paediatric imaging organizations and serve as a unified voice for issues pertaining to the practice of paediatric imaging (in discussion with Global Health Organizations).
Children and radiation in medicine

- Children are different
- The radiation risk
  - Children are more radiosensitive
  - Longer lifetime to express any changes
Graph shows lifetime attributable risk of radiation-induced cancer incidence, as a function of age at exposure for males and females.

Cancer Incidence
Population average (male): 8.6%/Sv
Population average (female): 12.8%/Sv
Estimated Number and Collective Effective Doses from Various Categories of Imaging Procedures in the United States in 2006

<table>
<thead>
<tr>
<th>Procedure Type</th>
<th>No. of Procedures*</th>
<th>Percentage of Procedures</th>
<th>Collective Effective Dose</th>
<th>Per-capita Dose (mSv)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiographic and fluoroscopic†</td>
<td>293</td>
<td>74</td>
<td>100 000</td>
<td>0.33</td>
</tr>
<tr>
<td>Interventional</td>
<td>17</td>
<td>4</td>
<td>128 000</td>
<td>0.43</td>
</tr>
<tr>
<td>CT</td>
<td>67</td>
<td>17</td>
<td>440 000</td>
<td>1.47</td>
</tr>
<tr>
<td>Nuclear medicine</td>
<td>18</td>
<td>5</td>
<td>231 000</td>
<td>0.77</td>
</tr>
<tr>
<td>Total</td>
<td>395</td>
<td>100</td>
<td>899 000</td>
<td>3.00</td>
</tr>
</tbody>
</table>

Source—Reference 10.
* In millions.
†Includes mammographic examinations but not dental radiographic
Continuous increase in CT utilization

- Radiation burden from diagnostic imaging ↑
- More and more children undergo CT
- 7 million pediatric CTs / year in USA
- 30% may be not indicated (justification?)
  (overutilization!)
U.S. annual per-capita effective radiation dose from various sources.

1980

2006

Hricak H et al. Radiology 2011;258:889-905

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• public and professional **awareness** of potential **risk** (inside and outside of radiology) have increased.
„Is computed tomography safe“?

Rebecca Smith – Bindman, Perspective
July 1, 2010; N Engl J Med. 363;1, p.1-4:

….. that patients undergoing CT receive the minimum radiation dose possible to produce a medical benefit.
NEW
FDA attention

- CT
- NM
- fluoroscopy
  advocating the two principles of radiation protection
    - appropriate justification
    - optimisation of the radiation dose
Pediatric CT
a challenge indeed

to guarantee:

• unharmed individuals for decades

• justification/optimisation/integration

• the ALARA-principle
International/Multinational Initiatives

- „Image Gently Campaign“
- ESPR taskforce CT dose
  - „the ESPR CT-project“
ESPR Task Force CT-dose goals

• to create excellence in research on justification and optimisation of computed tomography in children and young adults
• to provide a platform for continuous communication and discussion
ESPR Task Force CT-dose goals

- to provide continuous education under quality assurance criteria
- to develop guidelines of good clinical practice in pediatric CT
The ESPR CT-project

superior goals

• to develop an universal tool
  ➔ enabling „evidence based“ pediatric CT-protocol development irrespective of CT-type and
  – technology adjusted to
  - age
  - medical question
  - frequency
The ESPR CT-project

superior goals

• to tailor protocols as far as reasonable
• to make the process understandable, reproducible and feasible
• to develop a widely applicable approach
European medical exposure directive 97/43/EURATOM

- establishment and use of DRLs
- Joint responsibility ensuring appropriate justification (prescriber and practitioner)
  - applies to both
    + new applications
    + individual medical exposure
• techniques must be optimized according to ALARA-principle
• written protocols for every standard rad. procedure
• appropriate quality assurance programs
European medical exposure directive
97/43/EURATOM

- equipment → dose display
- individual dose records (DLP or CTDI in CT – F, A, …)
to move ahead in Europe

- to unify European DRLs for children
  - radiography
  - fluoroscopy
  - CT
  - Nuclear-Medicine
to move ahead in Europe

• to renew and redistribute quality criteria for good clinical practice in Pediatric Radiology
what resources are available?

• currently no EU-research grants
• only local/national grants (e.g. Medical University of Graz)
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what needs to be done?

- collaborative efforts worldwide!!
- cooperation with the industry globally
- intensify EU – lobbying
- application for EU – research grants
- intensify communication and cooperation with Global Health Organisations
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- protecting the young patients

strategies for developing countries

- education/training
  - increase awareness of radiation risk
  - increase knowledge on radiation protection
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- protecting the young patients

strategies for developing countries

• education /training
  - how to produce appropriate quality and low dose with simple equipment
  - of non-radiologists and technicians
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strategies for developing countries

- development of simple and robust X-ray equipment – WFPI as adviser of WHO
- push forward the shift to digital radiography in poor countries
  → teleradiology via JPEG-compression
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strategies for developed countries

- education
  - increase knowledge on CT-efficacy in childhood diseases
  ➔ focus on justification
    - avoid overutilisation
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- protecting the young patients
strategies for developed countries

• research
  - focus on development of pediatric CT-protocols, balancing dose and quality
  - on what is appropriate quality
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strategies for developed countries

- research
  - establish multiinstitutional research projects on CT-efficacy in children
  ➔ justification based on EBM criteria
• growing awareness of increased radiation risk in children worldwide
• increasing of per-capita effective dose from medical procedures in developed countries
• continuous increase in CT-utilisation in developed countries
Conclusion

- overutilisation of CT is a problem of developed countries
- improving and intensifying cooperation with industry globally
- multinational multiinstitutional research projects of impact on efficacy of pediatric CT
Conclusion

- focusing on justification and optimization of pediatric CT
- urgent need in education/training for developing countries
- teleradiology for developing countries could be an option
• intensifying communication and cooperation with WHO/IAEA
• World Federation of Pediatric Imaging will play a major role