

RADIATION IN TRAUMA – HARMFUL OR HELPFUL

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Radiation in Trauma

Harmful or Helpful ?

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Harmful or Helpful ?

It's helpful, without any doubt, because

- early diagnosis is vital,
- ultrasound alone is by far not sufficient,
- and MRI takes too long.

But:

- Shouldn't ALARA be observed nonetheless ?
- Shouldn't CT imaging be minimised ?
- Shouldn't MSCT be avoided ?

CT & Radiation Exposure

Examinations

Collective Effective Dose

Ref.: German Federal Office for Radiation Protection (1994)

Dose Descriptors

CTDI _{vol} (mGy) (per scan or rotation)	DLP (mGy · cm) (per examination)	Eff. Dose E (mSv) (per examination)
<u>Local dose</u> (Intensity)	<u>Integral dose</u> (Intensity & Extension)	<u>Risk related dose</u> (Intensity & Extension & Sensitivity)
Depends on • kV • mAs • Slice collimation • Pitch • Scan protocol	Depends on • Local dose • Scan length • Number of series • User preferences	Depends on • Integral dose • Patient size • Body region • Patient factors

How Big Are CT Doses ?

German CT survey 1999 (SSCT only)

- First broad-scale CT survey world-wide since 10 years
- Documentation of current CT practice
- Establishment of dose reference values

2000 CT scanners installed in Germany in 1999

- Approximately 1700 contacted
- Participation: 50% (n = 830)

Report

- Published in Roefo 10/2001 (in German)
- Abstract also in English.

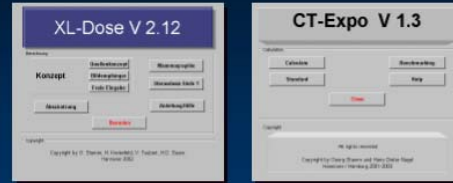
Results

Average effective dose per examination: 8 mSv
Range: 1 - 25 mSv

Trauma Scenarios

- Scenario #1: head and neck trauma
 - Conventional X-ray plus CCT + C-spine CT (CSP)
- Scenario #2: head, neck and chest trauma
 - Conventional X-ray plus CCT + CSP + TCT
- Scenario #3: head, neck and abdomen trauma
 - Conventional X-ray plus CCT + CSP + ACT
- Scenario #4: whole body trauma
 - Conventional X-ray plus CCT + CSP + TCT + ACT
- Scenario #5: whole body trauma
 - MSCT only: CCT + CSP + T/ACT

Dose Calculation Tools



For conventional radiography

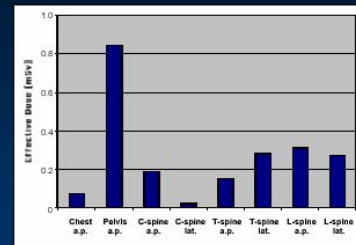
For computed tomography

Conventional X-ray Examinations

- Chest a.p.: 125 kV, Speed 400, field size 35 · 40 *
- Pelvis a.p.: 75 kV, Speed 400, field size 35 · 35 *
- C-spine a.p.: 70 kV, Speed 400, field size 10 · 24 *
- C-spine lat.: 70 kV, Speed 400, field size 18 · 30 *
- T-spine a.p.: 70 kV, Speed 400, field size 15 · 40 *
- T-spine lat.: 77 kV, Speed 400, field size 18 · 40 *
- L-spine a.p.: 79 kV, Speed 400, field size 18 · 40 *
- L-spine lat.: 90 kV, Speed 400, field size 18 · 40 *

* field size (in cm/cm) in image receptor plane

Conventional X-ray Doses



Summary II

- In trauma, radiation surely does much more good than harm
- Nevertheless, ALARA should be practiced, too
- Conventional x-ray dose is of minor importance
- CT doses can be quite high, but ...
- CT is very helpful in early diagnosis
- What to do?
 - Be prepared for different scenarios
 - Optimize each single protocol beforehand
 - Have dedicated paediatric protocols available
 - Confine scan length and phases to what is needed
 - Avoid whole-body MSCT unless indicated.