Ask EuroSafe Imaging Tips & Tricks

Paediatric Working Group

Child-sized CT

Raija Seuri (HUS Medical Imaging Center, FI)
Cristina Almeida (Centro Hospitalar de Lisboa Central, PT)
Theocharis Berris (University of Crete, GR)
Because of the radiosensitivity of children, both justification and optimisation of CT procedures need special attention

- CT is a modality of potentially high patient dose
- The dose can be greatly affected by procedure optimisation
  - Right technical parameters to ensure the right image quality for the indication
  - No need for pre-contrast scans in body imaging
- Optimised protocols should be based on patient size (weight, BMI, ...) because of the great variation of size in the same age
- Dose information should be recorded and regularly compared to Diagnostic Reference Levels (DRLs)
Justification

- Referrals should be reviewed by a radiologist to confirm that CT is the right modality for the patient in the given situation concerning the risks e.g.
  - Radiation exposure
  - Need of general anesthesia/sedation
  - Expertise available

- Adult rules of justification do not always apply to children
  - Head CT in minor trauma (Pickering et al, 2011)
  - SLOW (second look if otherwise well) - ultrasound instead of trauma CT (Scaife, Rollins, 2010)
Optimisation of the CT procedure in paediatrics

- Patient co-operation
  - Need of sedation/general anesthesia

- Use of contrast media
  - Pre-contrast scans are not needed in paediatric body CT
  - i.v. contrast: volume, injection rate, timing
  - p.o. contrast

- Image quality needed
  - Indication

- Technical parameters to ensure the image quality according to the ALARA principle
  - Protocols according to patient size, not age (except for head CT) and taking into consideration the clinical task
  - SFOV, DFOV, kV, mAs, pitch
  - Slice thickness
Tube current, mAs

- Patient dose is directly proportional to the tube loading
- Tube current modulation techniques should always be considered
  - Body examinations: routinely
  - Head examinations: depend on the scanner type and scanning technique (axial, spiral)
  - Extremities: often not feasible, especially in small children and if the extremity (knee, ankle, wrist) cannot be placed in the isocenter
Tube voltage, kV

- Use kV modulation if available, but lower tube voltage (70-100 kV) can also be chosen without automatic modulation

- Lower tube voltage may be used especially for smaller patients for lower dose
  - mAs increase might be needed to maintain the image quality

- Lower kV (nearer to the k-edge of Iodine) gives better contrast especially in CT-angiography
  - Better contrast-to-noise-ratio may allow more noise without compromising the diagnostic image quality
Scan field-of-view (SFOV) and diagnostic field-of-view (DFOV)

- Some scanners have different scan field of view (SFOV) for different paediatric protocols
  - SFOV should cover the whole patient to avoid artifacts
  - The different shape of the bow-tie filter affects the dose distribution and patient dose

- Diagnostic field of view (DFOV) should cover the area of interest
  - Smaller DFOV = better spatial resolution
  - DFOV can be changed and new reconstructions made afterwards if needed
Reconstructed slice thickness, windowing (and image quality)

- Reconstructed slice thickness chosen according to patient size and indication of imaging
  - The thicker the slice, the less noise in the image = lower radiation dose needed.
  - Though very thin slices (1-2mm) are sometimes needed, indication should be kept in mind.
    - Thin slices might be needed in paediatric CTA, but not when looking for an abscess.
  - More noise in the image might be tolerable with wider windowing without compromising the image quality
    - CTA
    - Low kV imaging
Conclusion

- Referrals for paediatric CT should be evaluated beforehand for justification and procedure optimisation
- Protocols according to patient size, not age (except for head CT) and taking into consideration the clinical task
- Dose optimisation is possible also with older equipment
  - Image quality by indication
  - Lower kV especially for CTA
  - Reconstructed slice thickness

Trauma protocol
- kV 120
- CTDI 6.2 mGy

Renal stone protocol
- Kv 100
- CTDI 2.0 mGy
Literature


- Scaife, Rollins: Managing radiation risk in the evaluation of pediatric trauma patient; Seminars in pediatric surgery 2010

- Guideline for paediatric CT examinations, Radiation and Nuclear Authority STUK 2012. [www.stuk.fi](http://www.stuk.fi)

- Image Gently. [www.imagegently.org](http://www.imagegently.org)