

Ask EuroSafe Imaging Tips & Tricks

Paediatric Working Group

Child-sized CT

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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)

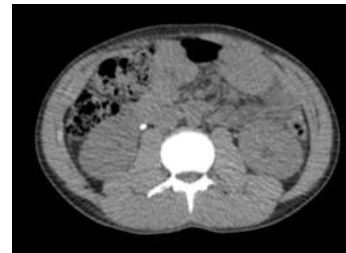
- ❑ Reconstructed slice thickness chosen according to patient size and indication of imaging
 - ❑ The thicker the slice, the less noise in the image = lower radiation dose needed.
 - ❑ Though very thin slices (1-2mm) are sometimes needed, indication should be kept in mind.
 - ❑ Thin slices might be needed 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

- ❑ Pickering et al: Clinical decision rules for children with minor head injury: a systematic review, Arch Dis Child 2011
- ❑ 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
- ❑ Image Gently. www.imagegently.org

