

Dose reduction strategies in pediatric CT examinations

Sangalli P.L.[°], Palleri F^{*}., Lombardi A.L.[°], Biggi S.[°], Belli V[°], Irmici C.[°],Scarascia M.[°], Schiavi M.[°], Campaniello G.[§], Montali F. [§], Ghetti C.^{*}, Ruffini L.[°]

[°] Department of Diagnostic Imaging, Azienda Ospedaliero Universitaria di Parma, Italy.

^{*} Medical Physics Department, Azienda Ospedaliero-Universitaria di Parma, Italy.

[§] Cinical Governance, Azienda Ospedaliero-Universitaria di Parma, Italy.



Aim of the study

Pediatric patients are more susceptible to the risks arising from exposure to ionizing radiation than adults. For pediatric patients exposed for medical purposes an optimization in radiation protection becomes necessary, in particular in Computed Tomography (CT) because the doses received by patients are higher than those imparted in conventional X-ray examinations.

Materials and Methods

We have studied 27 patients between 0 and 15 years old undergoing body CT examinations (20 thoracic CT and 7 abdominal CT) using a dual-source CT scanner (Somatom Definition Flash Siemens Healthcare) equipped with innovative systems of dose reduction: Siemens CarekV, suggesting the most suitable value for kV and Safire that is a new iterative reconstruction algorithm that can allow a current reduction with no degradation in image quality. The examinations were acquired using pediatric protocols available on the system, looking at the size of the patient, optimizing acquisition parameters (kV, mAs, pitch, collimation) using the mentioned tools and traditional modulation system (Siemens CareDose). We have also reduced the number of multiphase studies, the length of scan and we have positioned lead apron on organ just near the radiation field to protect them from scatter radiation. For each exam were have registered patient's age, the district examined, computed tomography dose index(CTDIvol), the dose-length product (DLP) and then we have calculated effective dose. We have divided patients into 4 groups (0-1, 2-5, 6-10, 11-15 years old) and for each group we have evaluated the mean value of CTDIvol, DLP and Effective Dose for thoracic and abdominal district. The dosimetric values obtained were compared with the same kind of data obtained analyzing 100 pediatric examinations carried out with the same CT scanner before optimization.

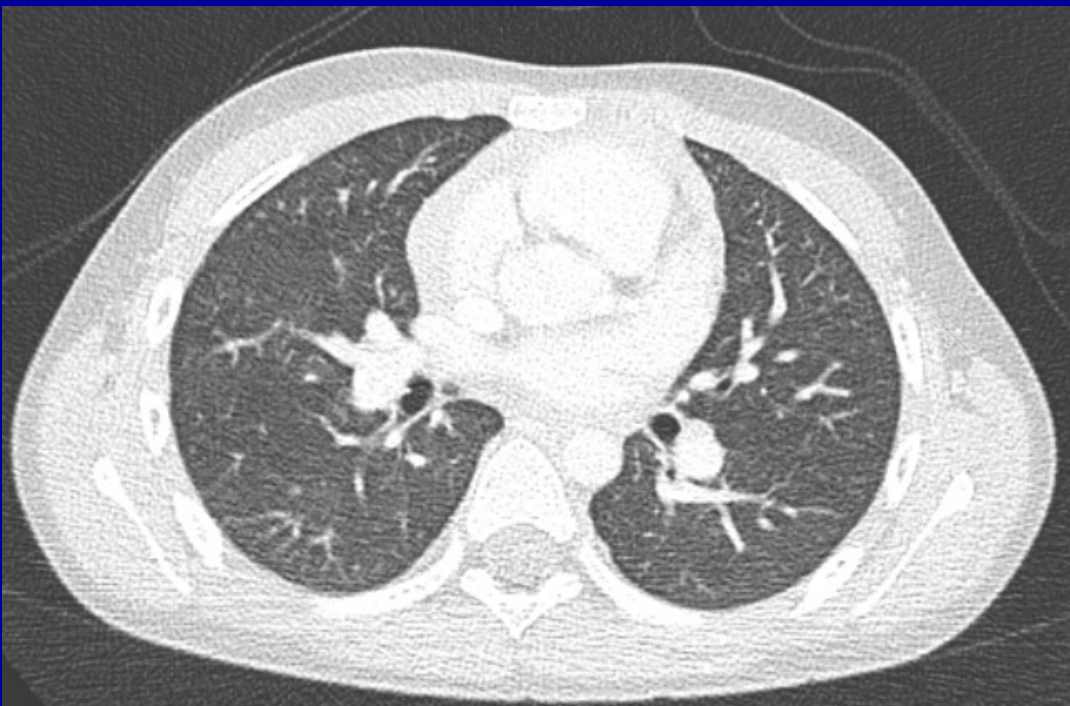
Results and Conclusions

a)

age	n° thoracic CT	CTDIvol (mGy)	% Diff	DLP (mGycm)	% Diff	E(mSv)	% Diff
0-1	2	1.2	- 37 %	25	- 53 %	1.5	- 37 %
2-5	5	1.6	- 42 %	31	- 47 %	1.2	- 36 %
6-10	9	1.7	- 58 %	51	- 71 %	1.2	- 69 %
11-15	4	4.2	- 5 %	199	- 25 %	3.3	- 8 %

b)

age	n° abdominal CT	CTDIvol (mGy)	% Diff	DLP (mGycm)	% Diff	E(mSv)	% Diff
0-1	1	1.3	n.a.	32	n.a.	1.9	n.a.
2-5	2	2.4	- 55 %	97	- 22 %	4.8	- 30 %
6-10	2	2.9	- 48 %	126	- 45 %	3.1	- 48 %
11-15	2	6.0	- 35 %	353	- 18 %	8.6	- 32 %



Transverse image of a pediatric CT examination

Table - CTDIvol, DLP, Effective Dose (E) mean values after the optimization process for thoracic (a) and abdominal (b) CT examinations and percentage differences respect to previously calculated values.

After optimization CTDIvol, DLP and Effective Dose values have been greatly reduced. Our data are very similar to European Diagnostic Reference Levels reported in ICRP 121 for Germany , that are the lowest values registered in Europe at the moment.