

Patient dose optimization in paediatric CT

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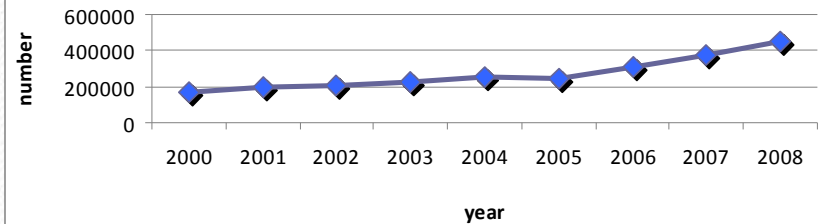
Introduction

- In the framework of IAEA TC Project RER/ 9/093 „Strengthening Radiological Protection of Patients and Medical Exposure Control “, Slovakia took part in collecting data to assess the radiation load of paediatric patients undergoing CT examinations of the head, thorax and abdomen. In selected CT departments, the examination of head was the most frequent type used, covering roughly 45% of CT scans in total.
- According to ICRP Recommendations 103 (2007) the eye lens is the most radiosensitive human tissue and therefore CT scanning of the head, representing a dose in the range of 0,03 – 0,13 Gy for children's eyes, can potentially lead to central opacity which might grow into recognizable cataract. Considering the above mentioned remarks, CT examination of young paediatric patients requires optimization of the eye lens doses.

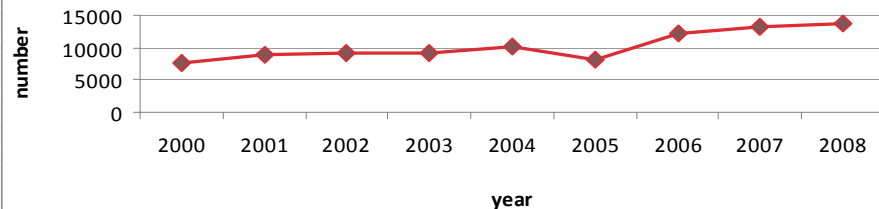
Situation in Slovakia

- During the last 10 years the number of CT examinations and CT departments has been growing and we recognize this trend even in paediatric CT examinations, which represent a very specific group from the view of radiation protection.

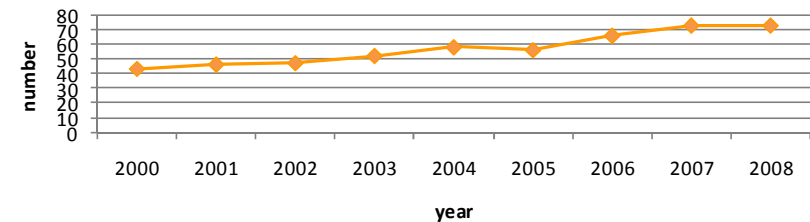
Number of all CT examinations in 2000-2008



Number of CT children examinations 2000-2008



Number of CT departments in 2000-2008



CT shield research

- As an option to reduce the radiation load from head CT examination of children we have chosen commercially available bismuth eye and thyroid CT shields (Somatex), doing measurements to clarify how their usage can affect the eye and thyroid doses. Also we asked different radiologists in selected CT departments about their satisfaction with these CT shields and the quality of images .



Materials and methods

- For our measurements we have chosen the CT department which had participated in IAEA TC Project RER/ 9/093.
- 2 CT departments had spent 2 months (june –july 2010) using bizmuth shields and provided us with their opinions afterwards.
- At the same time we proceeded with our measurements using antropomorphic phantom of a child (1 year old) simulated paediatric patient and bizmuth shields for eyes and thyroid.
- We exposed the phantom to 107 TLDs - LiF:Mg,Cu, P and the evaluation was made on Harshaw 3 500
- The exposure was according to the standard protocols for head examinations – 120kV,AP,axial,pitch=1, AEC

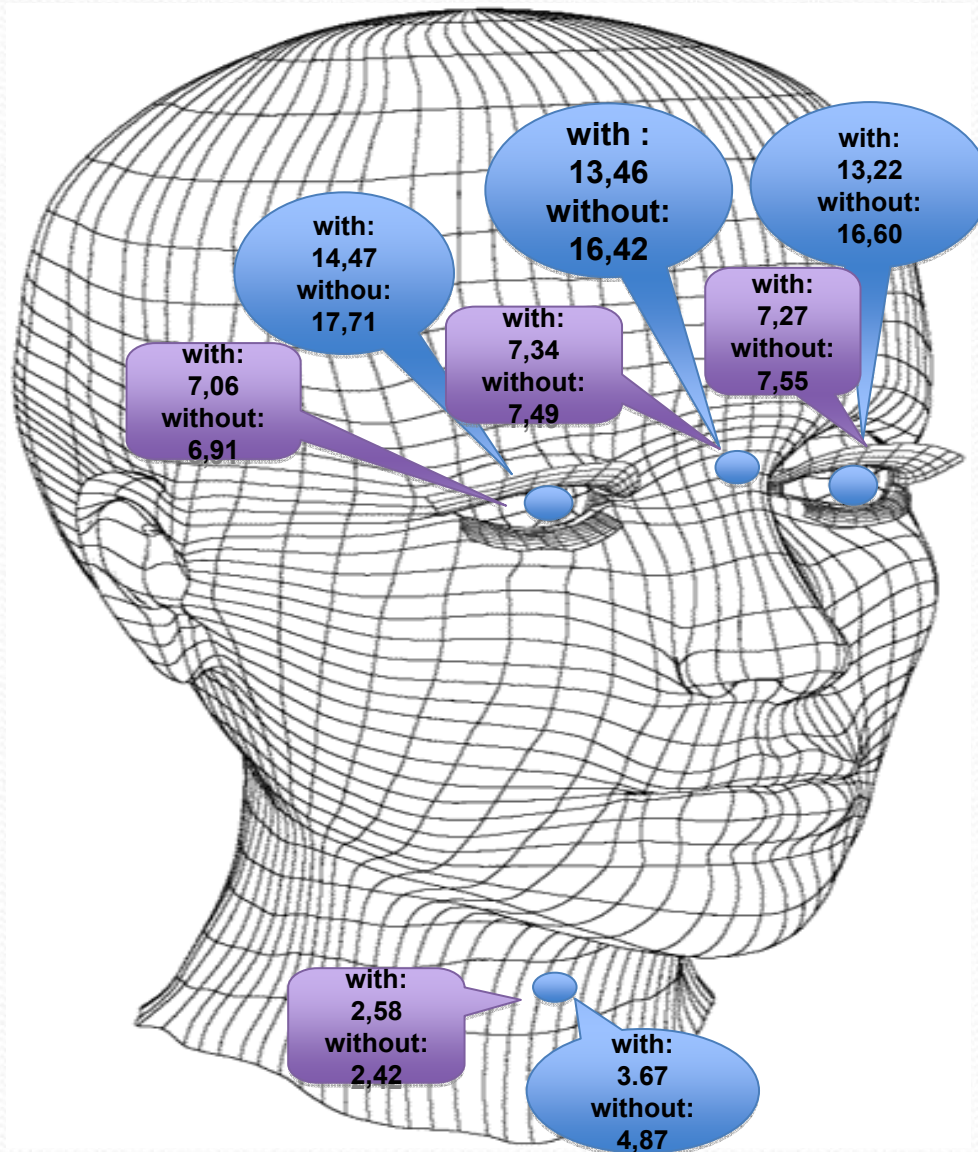
Table of chosen departments:

Hospital	CT producer	Model	Year	N. of detectors row
Childrens Hospital	PHILIPS	Brilliance 40	2009	40
Pro RTG	Siemens	Somaton Emotion	2005	1



Average eye and thyroid doses(mGy) in 2 departments with and without bismuth CT shields.

Results



- From our results we can say that the effect on eye doses differs depending on the type of CT equipment used. The older CT equipment proved reduction on the eyes from 18-20% compared to the other department, where we actually noted an increase of 2% on the left eye, but there was reduction of 4% on the right eye.
- For thyroid we have recorded a reduction of radiation by 25%, but only on the older CT machine. In the other department we noted an increase again.
- Both departments had been satisfied with the eye bismuth shields for their easy usage, but in the case of thyroid shield, they noticed artefacts and therefore worse image quality.

Discussion

- Despite the fact that our results have mostly shown reduction of radiation dose from 2 - 25% , it is also necessary to mention opinions of other specialists in radiation protection, who suggest that similar reduction can be achieved by tube current reduction and without any impact on the image quality (artefacts from the shields). We also need to mention that radiologists are not dissatisfied with slightly decreased image quality, when they were using CT shields, which shows that they were potentially able to rebuild their scanning protocols for dose reduction. Interaction between bismuth shield and radiation is disputable as well.

Conclusion

- From our research it is clear that the usage of CT shields does not necessarily provide reduction of radiation load to eyes and thyroid, and therefore, to be able to provide any recommendations, it is necessary to make individual measurements before applying the shields to practice in the specific CT department. We assume that bismuth shields might be effective in CT departments with older equipment, but we are sure that in the new departments it is a better option to renew their scanning protocols.



- Thank you for your attention