

# Quality Improvement

Decreasing potential for cataract formation by reducing radiation exposure of lenses during CT examination of the head

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# Overview

- In the United States, about 65 million adult and 5 million pediatric CT examinations are performed each year
- The lenses of the eyes are the organs most sensitive to radiation injury because of their superficial location and direct contact with the xray beam
- For reference, the recommendations by the International Commission on Radiologic Protection for occupational exposure, the equivalent dose limit for the lens of the eye should be 20 mSv in a year, averaged over a defined period of 5 years, with exposure not exceeding 50 mSv in any single year

# Overview

- Medical radiation–induced cataracts, especially those resulting from head and neck CT studies where the lenses are potentially directly radiated, are an issue of concern
- In the population-based study by Yuan et al published in AJR (201) September 2013, they aimed to determine the risk of cataract associated with repeated radiation exposure from head and neck CT

# Yuan et al AJR:201 September 2013

- Random sample of 2 million persons enrolled in the nationally representative Taiwan National Health Insurance Research Database
- Exposed population with head and neck tumor 10–50 years old who underwent at least one CT between 2000 and 2009
- Non-exposed control group was composed of subjects who were never exposed to CT studies but who were matched by time of enrollment, age, sex, history of coronary artery disease, hypertension, and diabetes

# Yuan et al AJR:201 September 2013

- 2776 patients in the exposed group and 27,761 matched subjects in the nonexposed group
- Exposed group had higher overall incidence of cataracts (0.97% vs 0.72%; adjusted hazard ratio [HR], 1.76; 95% CI, 1.18–2.63)
- Further stratifying the number of CT studies in the exposed group into one or two, three or four, and five or more revealed that cataract incidence increased gradually with increasing frequency of CT studies

# Yuan et al AJR:201 September 2013

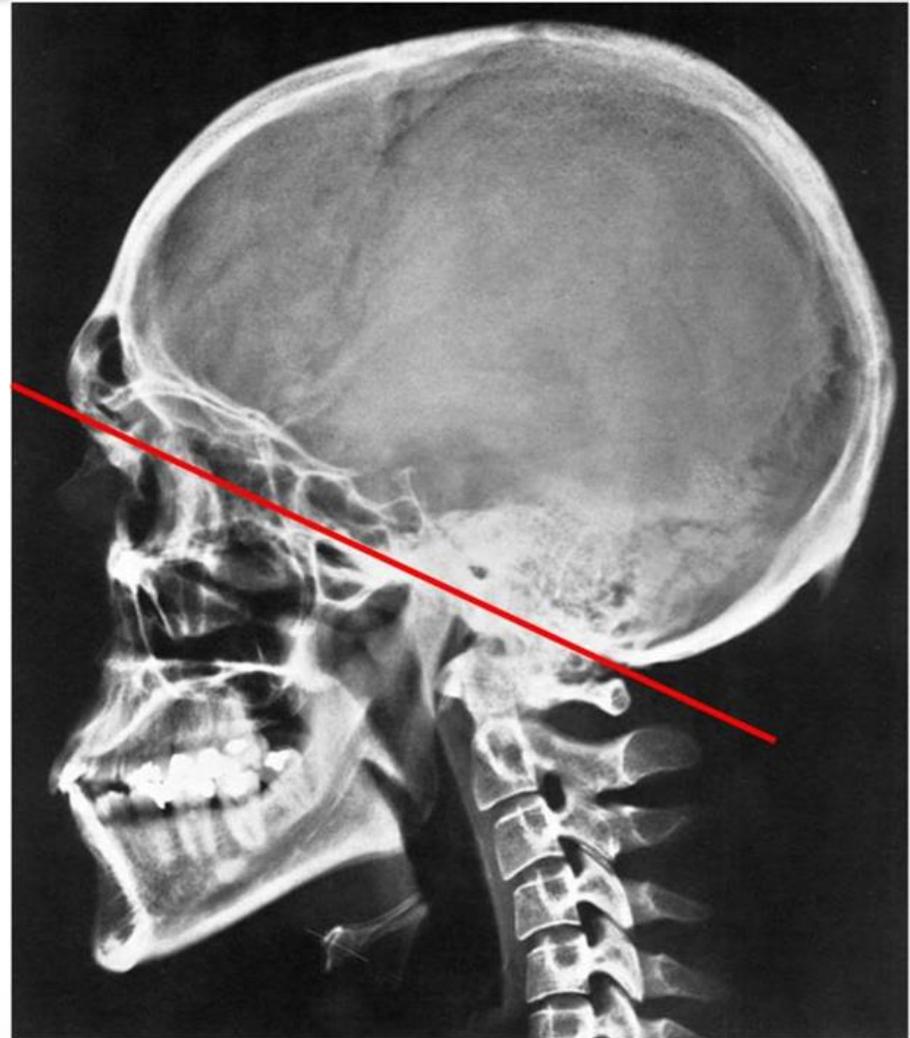
- Radiation exposure due to repeated head and neck CT studies was independently associated with an increased risk of developing cataracts when the cumulative CT exposure frequency involved more than four studies

# Quality improvement

- In an attempt to reduce radiation exposure of lenses and decrease potential cataract formation at our institution, we changed the gantry angle to exclude lenses on head CT's
- Trauma patients were excluded due to the time sensitivity of the majority of these exams

# Quality improvement

- CT technologists were instructed to obtain the following scan angle on the head CT exams



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# Quality improvement

- After educating the CT technologists of the new change and allowing sufficient time to incorporate the new protocol, a retrospective analysis was performed to evaluate the number of eye lenses irradiated on head CT exams before the new scan angle was implemented, and how many lenses were irradiated after the change was made

# Data

- A randomly sampled population of 30 patients with previous CT of the head performed prior to the implementation of the new protocol were selected
- Number of lenses directly irradiated within the field of view on these exams: 100% (60 lenses)

# Data

- Additionally, a randomly sampled population of 30 patients with non-trauma head CT's performed following initiation of the new protocol were selected
- Number of eye lenses directly irradiated within the field of view on these exams: 45% (27 out of 60)

# Summary

- Implementation of the new scan angle for head CT's resulted in a 55% reduction in the number of directly irradiated eye lenses
- As was discussed on prior slides, the population based study by Yuan et al indicates that this reduction in lenses irradiated could potentially result in significant reduction in radiation induced cataract formation, particularly in patients who have multiple head CT exams

# Summary

- In conclusion, results determined that more than half the post protocol implementation head CT's did not scan the lenses. However, further teaching and instruction to the CT technologists, particularly the night and weekend shift (as the radiologists are not around to answer questions), would likely reduce the number of lenses scanned even further and is a goal to strive for in the future.

# References

- Yuan, M.K., Tsai, D.C, Chang, S.C., Yuan, M.C., Chang, S.J., Chen, H.W., Leu, H.B. (2013). The Risk of Cataract Associated With Repeated Head and Neck CT Studies: A nationwide population-based study. *AJR*, 201, 626-630.