An Issue with Proximity: A Clinical Audit of Optic Lens Involvement in CT Head Imaging

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Canadian Association of Radiologist 77th ASM  
April 26, 2014
OVERVIEW

• Background
• Radiation Dose Limits to the Lens
• Audit Process
• Re-Audit Results
• Summary
DECLARATION

I have received no financial support for this study

I have no conflicts of interest to declare
BACKGROUND

• Computed tomography (CT) is a commonly used imaging modality.

• Optic lens plays a minuscule role in the patient.

• Unnecessary exposure of the lens to radiation can result in cataract formation.
# Structure Radio-Sensitivities

<table>
<thead>
<tr>
<th>High</th>
<th>Medium</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lymphoid Tissue</td>
<td>Skin</td>
<td>Muscle</td>
</tr>
<tr>
<td>Marrow</td>
<td>Vascular endothelium</td>
<td>Bone</td>
</tr>
<tr>
<td>GI Epithelium</td>
<td>Lung</td>
<td>Connective tissue</td>
</tr>
<tr>
<td>Gonads</td>
<td>Kidney</td>
<td>Cartilage</td>
</tr>
<tr>
<td>Embryos</td>
<td>Liver</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lens</td>
<td></td>
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</tbody>
</table>
LIMITS OF LENS RADIATION

• The lens is typically exposed to between 25-103 mSv of radiation during a CT head study.\textsuperscript{3,4}

• The International Commission on Radiological Protection\textsuperscript{5,6} has decreased the radiation threshold for the optic lens to:
  – 500 mSv for chronic exposure and 500-2000 mSv for acute exposure.

• For occupationally exposed workers, 20 mSv/y, defined.
Examining Lens Involvement in CT Head Studies at SLMHC
STUDY AIM

• To assess the proportion CT head studies performed at SLMHC that involved the optic lens

• To minimize the involvement and resulting radiation of the optic lens during CT head studies
STANDARDS

• No guidelines comment on the avoidance of optic lenses in CT head studies at SLMHC
• The literature suggests that avoidance of the optic lens in CT head studies has benefits to prevent lens pathology\textsuperscript{7,8}
METHODS

• A retrospective study of all CT head studies between a 4 month period in 2013
• Lens involvement defined as:
  – Partial or complete visualization of either lens
  – Cataract surgery; orbits were involved
• Initial results presented to and discussed with the departmental staff
• Re-audit took place immediately after and occurred over a 2 month period
• Exclusion criteria:
  – Orbits requested
  – Facial trauma
INITIAL RESULTS

• Of the 101 CT head studies:
  – 78.2% (n=79) cases involved the lens
  – 68.3% (n=69) involved both lens
RECOMMENDATIONS

• Discussion between DI department staff
• Radiation reduction strategies suggested:
  – Angling the gantry to avoid the primary beam
    • Lens may still be susceptible to scattered X-rays
  – Positioning the patient
    • Cervical spine hyperflexed
• Document issues encountered which prevented usage of the above strategies
  – Trauma
  – Cervical spine mobility
ANGLING THE GANTRY

Gantry angled demonstrating lens involvement in CT head
Angling the gantry above the level of the orbits and “tucked” position, we can effectively minimize the exposure of the lens to radiation in CT head studies.

Yellow: Lens involved  Blue: Lens Avoided
RE-AUDIT: RESULTS

- A total of 61 cases were studied.
- 22.9% (n=14) of the studies involved the lens.
- Of the 14 studies with lens involvement, 71.4% (n=10) were documented as trauma or concerns with cervical spine.
LIMITATIONS

• Small sample size
• Technologist experience with CT
  – CT is new to SLMHC and technologists are currently building experience
• Comfort level of technologists
  – Manipulating cervical spine
SUMMARY

• Unless indicated, we can exclude the lens in image collection by angling the gantry above the orbits and having patients in the tucked position.

• Successful reduction of radiation dose to the lens during a CT head study.

• Participatory Research is a successful method to initiate change and promote a team-work environment.
REFERENCES

QUESTIONS?