Radiation Protection Aspects of Eye Plaque Therapy for Ocular Cancer

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Objectives

• Understand principles of episcleral therapy for ocular tumors using eye plaques
• Understand types of radioactive material used in eye plaques and radiation emitted from eye plaques
• Put radiation exposure from eye plaque patients into perspective
• Learn ways to minimize staff radiation exposure
Treating Intraocular Cancer

• The most effective treatment is *enucleation* (surgical removal of the eye)
  – destroys vision
  – gives a poor cosmetic result

• Radiation therapy can:
  – be an effective treatment
  – preserve vision and the eye

• The most commonly used form of radiation is *episcleral plaque therapy*
Episcleral Plaque Therapy

Episcleral means “on top of the sclera”. A thin disk (“plaque”) containing radioactive material is attached to the sclera. Radiation emitted by the plaque irradiates the tumor, preferentially killing malignant cells.
“Seeds” and Plaques

“Seeds” are tiny tubes made out of an inert metal such as titanium that contain radioactive material.

The seeds are placed into the disk-shaped plaque, which has a backing of gold that acts a shield.
Under general anesthesia, the plaque containing the seeds is placed onto the sclera adjacent to the tumor and sutured into place. The arrangement of the seeds determines the radiation dose to the tumor.
Radioactive Material Used in Seeds

• Radioactive iodine-125:
  – is used in seeds
  – emits gamma rays (similar to x-rays) of very low energy
  – cannot leak out of the seed / plaque

• The gamma rays:
  – penetrate only a few millimeters into the eye
  – irradiate tumor with very high doses of radiation
  – other structures in the eye and head receive very low doses

• The gold backing on the plaque:
  – absorbs the gamma rays
  – prevent exposure to the surgery team and recovery room nursing staff

• An additional lead “eye patch” further protects floor nurses and family
After the Surgery…

- The patient is taken to the recovery room
- Stray gamma rays that are not absorbed by the shielding or the patient’s tissues may expose nursing staff to radiation
- Such unnecessary radiation exposure should be minimized
- There are three key methods we recommend to minimize radiation exposure
The Four Key Radiation Protection Principles

• TIME
• DISTANCE
• SHIELDING
• ALARA (As Low As Reasonably Achievable)
Time

• The *less time* you spend within a radiation area, the *less radiation exposure* you will receive

• Working quickly will reduce radiation exposure

• *BUT*…working quickly may cause *mistakes or result in an unsafe environment*

• SO…*balance* speed with the need to provide good patient care
Distance

• The *further* you are away from a source of radiation, the *lower* your exposure

• *Doubling* your distance away from the plaque reduces your exposure by a factor of *four*

• Unless you are involved in a critical patient care task such as taking vital signs, keep a distance of three feet or more away from the plaque
Shielding

• A lead “eye patch”:
  – will be placed over the eye in the operative suite
  – eliminates stray gamma rays that emerge from the front of the eye

• Near-total protection is provided by:
  – The gold backing of the plaque
  – the patient’s head/body
  – the lead eye patch
How Much Radiation Do Bystanders Get From Eye Plaques?

<table>
<thead>
<tr>
<th>Situation</th>
<th>Duration</th>
<th>Time Spent in an Airliner at 35,000 feet That Would Result in the Same Radiation Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nurse taking vital signs at the bedside Q 2 hr x 12 hours</td>
<td>24 minutes (4 minutes each VS)</td>
<td>6 Minutes</td>
</tr>
<tr>
<td>Nurse observing patient at a distance of three feet</td>
<td>60 minutes</td>
<td>4 minutes</td>
</tr>
<tr>
<td>Visitor seated six feet from patient room</td>
<td>120 minutes</td>
<td>2 minutes</td>
</tr>
</tbody>
</table>
# Eye Plaque Radiation Exposure in Perspective

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Radiation Dose (millirem)</th>
<th>Time Spent at Eye Plaque Patient Bedside Required to Reach Benchmark Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>One day’s natural background radiation</td>
<td>0.8</td>
<td>3 hours</td>
</tr>
<tr>
<td>Plane Flight, NY to LA at 35,000 feet</td>
<td>5</td>
<td>20 hours</td>
</tr>
<tr>
<td>PA and LAT Chest X-ray</td>
<td>20</td>
<td>2 work weeks*</td>
</tr>
<tr>
<td>Quarterly ALARA Level 1 Dose</td>
<td>125</td>
<td>3 work months*</td>
</tr>
</tbody>
</table>

*Assumes eight (8) hour work-day, 5 days per week. “Time Spent” means continuous time without breaks.
Frequently Asked Questions

• Doesn’t the patient need to be in a shielded room like they have on 9300?
  – No

• Can the patient have visitors?
  – Yes. Visitors should stand or sit at least six feet away from the patient most of the time, but can get close to patient for brief periods

• Can pregnant women care for the patient?
  – Yes. There is no risk to the fetus at these very low doses

• Can the radioactive material get out of the plaque and contaminate us?
  – No. The radioactive material is permanently sealed within the plaque and will not escape
Frequently Asked Questions

• **Should we wear lead x-ray aprons when caring for an eye plaque patient?**
  – No. The risk of musculoskeletal injury far outweighs the negligible reduction in radiation risk afforded by shielding aprons

• **What if the patient has a cardiopulmonary arrest or other medical emergency?**
  – Perform a “Code Blue” just as if the patient were not radioactive. Even in the worst-case scenario, staff will not be subjected to any significant hazard

• **What if the plaque falls out?**
  – Do not touch the plaque with your fingers. Cover the plaque with the lead eye patch and immediately notify Radiation Oncology and Radiation Safety
Frequently Asked Questions

• **How do I contact Radiation Safety if I have a question, or there’s an emergency?**
  – For non-emergent questions, call the Radiation Safety Patient Technologist pager at (919) 970-9703
  – In an emergency (dislodged plaque), you can call 911 and tell the Duke Police you have a radiological emergency and you need Radiation Safety Assistance. They will contact us 24/7

• **Do I get to wear one of those “radiation protection badges”?**
  – No. The amount of radiation exposure you are expected to receive while caring for an eye plaque patient will be far too low for the badge to be able to measure your dose
Conclusions

• Radioactive eye plaques are an effective, vision-sparing form of therapy for intraocular cancer
• Radiation exposure from the shielded eye plaque is extremely low and does not present a significant hazard to staff or visitors
• Although exposure is low, it may be further reduced by the ALARA techniques of time and distance