Silicone Oil during I-125 Plaque Brachytherapy in the Treatment of Choroidal Melanoma

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Introduction

Purpose

• Plaque brachytherapy is an effective treatment for choroidal melanoma but damages healthy ocular structures.
• In vitro studies have shown the radiation attenuating effects of silicone oil on ocular structures; subsequent case series have showed potentially beneficial outcomes on post-operative macular morphology, architecture, and visual acuity.
• Does this radiation sparing procedure’s benefits outweigh its surgical risks in the community setting?

Background

• Previously, the treatment for choroidal melanoma was enucleation, to prevent metastasis.
• Since the Collaborative Ocular Melanoma Study (COMS), we know that plaque brachytherapy is as effective as enucleation, saves the eye, and can preserve vision.

• However, radiation retinopathy (RR) occurs due to radiation damage to retinal endothelial cells and manifests similarly to other vascular retinal pathology, with microaneurysms, revascularization, cotton wool spots, and macular edema.
• This complication has a delayed onset (months to years) and is slowly progressive.
• Demographic risk factors for developing RR include diabetes, hypertension, and male gender.
• Radiation dose to the macula, tumor size, and tumor distance from the fovea are also closely correlated to development of RR.

Methods

• Five patients who received a diagnosis of choroidal melanoma from 2011 to 2016 received I-125 plaque brachytherapy implanted by the same surgeon (BB), with prescribed doses of 85 Gy to tumor splices.
• Plaque placement was confirmed using indirect ophthalmoscopy and transillumination of the tumor intraoperatively.
• Fine needle aspiration biopsies of all tumors were collected via transluminal or transvitreal approach, followed by PPV with either 1000 or 5000 cGy silicone oil injection into the posterior segment.
• After seven days of therapy, the plaque and silicone oil were removed in a single procedure.
• A retrospective chart review was performed; data regarding relevant patient demographics, tumor location and size, and planned radiation doses to the macula are detailed in Table 1.
• Outcome measures including visual acuity, development of RR, and surgical complications are listed in Table 2.

• No patient developed melanoma recurrence.
• Patient demographics were skewed towards a higher risk for developing RR (DM, HTN, male gender).
• Additionally, 4/5 patients had tumors >4 mm thick and 2/5 had radiation doses of >80 Gy to the macula.
• The two patients who developed RR had the greatest doses of radiation to the macula with tumors located in the posterior pole encroaching on the macula.

Results

Table 1: Relevant Patient Demographics, Tumor Position, Macular Doses and Follow Up Time

<table>
<thead>
<tr>
<th>Demographic Risk Factors</th>
<th>Tumor Location</th>
</tr>
</thead>
</table>
| Diabetes (DM) | Eyes 
| Hypertension (HTN) | Eyes 
| Male Gender | Eyes 
| Tumor Size (mm) | Eyes 
| Radiation Dose (Gy) | Eyes 

Table 2: Outcome Measures

<table>
<thead>
<tr>
<th>Tumor Location</th>
<th>Visual Acuity</th>
<th>No RR</th>
<th>No Enucleation</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>20/20</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Inferotemporally</td>
<td>20/20</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Inferonasally</td>
<td>20/20</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Supranasally</td>
<td>20/20</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Supertemporally</td>
<td>20/20</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Conclusion

• Attenuation of RR seems to be augmented by utilization of silicone oil in certain situations.
• However, silicone oil can only attenuate radiation dose when it interposes between source and tissue.
• Tumors located more posteriorly may not benefit from this additional surgical maneuver especially when considering postoperative complications and operating time.
• Rather, we propose that it may beneficial to use location and size of tumor, along with anticipated macular radiation dosage to determine which individuals might benefit from silicone oil.

References

[8] Retina Consultants of Austin, 3705 Medical Pkwy #410, Austin, TX 78705