NEW LUTEIN-BASED DYSES FOR OPHTHALMIC SURGERY USE

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This summary about the “New Lutein-Based Dyes For Ophthalmic Surgery Use” is based on one article:


ABSTRACT

The purpose of this study was to determine whether a natural dye solution based on lutein* alone or combined with Brilliant Blue (BB) or Trypan Blue (TB) stains and facilitates peeling of intraocular membranes in human eyes. Different lutein concentrations were tested alone or combined with different BB or TB, on 102 cadaveric eyes. The natural dye solution based on lutein alone or combined with BB or TB efficiently stained the anterior lens capsule (AC), vitreous, and internal limiting membrane (ILM) in human cadaveric eyes and may be a useful tool for vitreoretinal or cataract surgery.

*Lutein possesses an isomer called zeaxanthin, which is also present in the formulation.

INTRODUCTION

In ophthalmology, vital dyes have long been used as diagnostic tools that enable surgeons to better visualize the semitransparent intraocular membranes and tissues, such as the AC and ILM.2 Chromovitrectomy, includes the use of vital dyes or crystals to improve visualization of the intraocular tissues during vitrectomy, optimizing the surgical results in the management of many vitreoretinal diseases.3

The ideal vital dyes should have a safety profile for intraocular use, the ability to reliably and selectively stain the intraocular membranes, and be able to be rapidly eliminated from the eye. There are many dyes available for chromovitrectomy, such as TB, patent blue, BB, indocyanine green, infracyanine green, and triamcinolone acetonide (TA).4,5 Some degree of toxicity, however, has been associated with the use of most of these dyes at certain concentrations.4,5

The purpose of this study was to determine whether the natural dye solutions based on lutein alone or in association with TB or BB, stain and facilitate peeling of the AC, vitreous, posterior cortical hyaloid, and ILM in human cadaveric eyes.

RESULTS

Solution Development. The solubility of lutein in different vehicles ranged from 0.02 mg/mL to 110 mg/mL. The absorbance of the solution of lutein alone or in combination with BB or TB was within a wavelength ranging from 250 nm to 1,000 nm at a speed of 600 nm/minute, using 1.4% polyvinyl alcohol as a white standard. The pH values ranged from 2.79 to 6.36, and the osmolalities ranged from 277 mOsm/Kg to 432 mOsm/Kg.
Anterior Capsule, Vitreous (Posterior Hyaloid), and ILM Identification. One hundred and two eyes were analyzed. The lutein dye solution alone or combined with BB or TB was injected directly over the different intraocular structures. The corneal endothelium, AC, vitreous, posterior hyaloid, and ILM were observed clearly by deposition of lutein alone or combined with BB or TB in all eyes (Table 1).

Table 1. Staining Results of Different Intraocular Structures Using Dye Solutions of Lutein Alone or Combined with BB or TB.

<table>
<thead>
<tr>
<th></th>
<th>Corneal Epithelium</th>
<th>Corneal Endothelium</th>
<th>AC</th>
<th>Vitreous</th>
<th>Posterior Hyaloid</th>
<th>ILM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lutein 20%</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>++++/4</td>
<td>++++/4</td>
<td>+/4</td>
</tr>
<tr>
<td>Lutein 0.25% and BB 0.025%</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>++/4</td>
<td>++++/4</td>
<td>++++/4</td>
</tr>
<tr>
<td>Lutein 0.25% and BB 0.0125%</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>+/4</td>
<td>++/4</td>
<td>++++/4</td>
</tr>
<tr>
<td>Lutein 0.7% and TB 0.04%</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>+/4</td>
<td>+/4</td>
<td>+/4</td>
</tr>
</tbody>
</table>

The AC was stained strongly (staining grade 4) with the solution of 0.25% lutein and 0.025% BB (Figure 1) and with the solution of 0.7% lutein and 0.04% TB (Figure 2).

The vitreous was removed successfully using a solution of lutein 20% alone (staining grade, ++++/4) (Figure 3). After the dye was removed by mechanical aspiration from the posterior pole, the underlying ILM that had been in contact with the dye was stained greenish blue/green in all 102 eyes (Figure 4). The staining of the ILM improved the ability to initiate peeling, and the unstained underlying retina was clearly visible. No complications developed during the surgical procedures.
Histologic Evaluation. The peeled ILMs underwent histopathologic evaluation, and light microscopy showed no changes in the ILM morphology. As expected in this cadaveric study, there was no histologic or clinical evidence of retinal toxicity other than the early postmortem changes. No retinal pigment epithelial or neurosensory abnormalities were clinically seen.

DISCUSSION

New dyes with a better safety profile than synthetic dyes are important for optimizing the outcome of modern ophthalmic surgery and natural dyes such as lutein offer a potentially safer and more efficacious method of identifying intraocular structures such as anterior capsule and ILM. Results from this study show that the lutein natural dye solution alone or combined with BB or TB facilitated the identification and removal of the corneal endothelium, AC, vitreous, posterior hyaloid, and ILM in cadaveric eyes, with no clinical or histologic signs of toxicity. Particularly, lutein alone seems to be useful for vitreous identification whereas combinations of lutein with BB seem to render the best results to identify and stain retinal membranes. Similarly, lutein combined with TB showed strong affinity to the AC.

References


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