Trypan Blue Staining of Epiretinal Membranes in Proliferative Vitreoretinopathy

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Objective: To determine whether trypan blue staining facilitates epiretinal membrane (ERM) removal in proliferative vitreoretinopathy.

Methods: In 10 patients undergoing vitrectomy for proliferative vitreoretinopathy, ERM peeling was performed without staining the tissue, until no additional ERMs were clearly visible. Then, after a fluid-air exchange, 0.06% trypan blue solution was applied onto the retinal surface. After 1 minute, all excess dye was removed and, after an air-fluid exchange, ERM peeling was completed. Excised ERM specimens were analyzed by transmission electron microscopy.

Main Outcome Measures: For each patient, the efficacy of trypan blue staining of ERMs during surgery was scored.

Results: In all patients, intraoperative staining of ERMs with trypan blue was found to be a useful adjunct, since the dye consistently improved direct visualization and delineation of ERMs and facilitated ERM removal. A clear contrast was created between the stained ERMs and the nonstaining, underlying retina. Electron microscopy showed that only ERM tissue was removed. No adverse reactions related to the use of the dye were observed up to 3 months after surgery.

Conclusions: Trypan blue may be an important new tool in the surgical management of proliferative vitreoretinopathy, since it may allow a more complete and safer ERM removal.

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Proliferative vitreoretinopathy (PVR) is characterized by the proliferation and contraction of nonvascular epiretinal membranes (ERMs) at the retinal-vitreous interface after rhegmatogenous retinal detachment. It is the most common cause of failure of rhegmatogenous retinal detachment surgery, with recurrent retinal detachment occurring in 5% to 10% of eyes.1

Although long-acting gases and silicone oil as tamponading agents have improved the outcome of PVR surgery, incomplete removal or ERMs during the first surgery may be a major cause of recurrent PVR with redetachment of the retina. Better visibility and delineation of the ERMs during PVR surgery may result in a more complete ERM removal and a higher rate of long-term retinal reattachment.2

The purpose of our study was to evaluate whether trypan blue staining facilitates visualization and delineation of ERMs, allowing a more complete ERM removal in PVR surgery.
The completeness of removal of tractional membranes is one of the most important prognostic factors influencing the outcome of PVR surgery. However, ERMs are often poorly visible because of their transparency, and a mild sheen or atypical wrinkling of the underlying retina may be the only indirect clue of their presence. When ERMs are visible, their actual extent may be much greater than that expected from their ophthalmoscopic aspect.

Recently, trypan blue staining of the anterior lens capsule was introduced to facilitate the capsulorrhexis during phacoemulsification procedures in the absence of a red fundus reflex. To our knowledge, no adverse effects have been reported after the intraocular use of the dye. We therefore speculated that trypan blue could have a use in posterior segment surgery.

Before our clinical study was conducted, the biocompatibility of 0.06% trypan blue was evaluated in vitro by an independent laboratory (BioScan, Laboratory for Medi-
cal Device Evaluation, Bilthoven, the Netherlands): cytotoxicty, extract, 24-hour end-point dilution tests were conducted according to the International Standardization Organization (ISO) 10993 and European Norm (EN) 30993 (H. W. B. Jansen, PhD, unpublished data, 2000). Retinal tissue changes after long-term exposure to trypan blue were also evaluated in an in vivo rabbit model. In that study, no tissue changes were detected with light and electron microscopy after continuous exposure of 0.06% trypan blue to the retina for 1 month, whereas high concentrations of the dye were associated with tissue changes in the inferior retinal quadrant.6

In the present study, trypan blue was found to create a useful contrast between the ERM and the nonstaining retina, thereby clearly delineating the extent of the ERM. This enabled a more complete removal of the ERMs, since ERMs that were unsuspected before injection of the dye were clearly visualized. Because the margins of the membranes were better delineated, the risk of inadvertent damage to the retina was also minimized.

Trypan blue was particularly useful in visualizing ERMs in long-standing and/or recurrent PVR. In contrast, in cases of early PVR with a majority of fresh, immature membranes, the density of trypan blue staining of the ERMs was found to be highly variable. Trypan blue also proved to be a helpful tool to assess whether the retinal surface was completely free of membranes at the time of silicone oil removal. During this procedure, trypan blue was applied to the retina after aspiration of the oil. The absence of staining of the retina at this stage supported our decision that silicone oil removal was safe to perform.

Recently, we also detected that trypan blue and indocyanine green may have complementary staining proper-
ties at the vitreoretinal interface in PVR: although trypan blue shows high affinity for mature ERMs, indocyanine green binds more selectively to the internal limiting membrane7 but may also stain some epiretinal PVR membranes (data not shown). A double staining technique with trypan blue and indocyanine green proved useful in patients with idiopathic premacular fibrosis (P.S., unpublished data, 2001).

In conclusion, trypan blue staining of ERMs was found to be a useful adjunct in the surgical management of PVR, since it allows a more complete and safer removal of ERMs. Long-term clinical studies are needed to determine whether this novel technique will ultimately result in a better anatomic and functional outcome of PVR surgery.

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