Upregulation of Pigment Epithelium–Derived Factor after Laser Photocoagulation

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PURPOSE: To determine the changes in the expression of pigment epithelium–derived factor in cultured human retinal pigment epithelial cells and rat retinas after laser photocoagulation.

METHODS: Experimental study of laser photocoagulation on human retinal pigment epithelial cells in culture and on adult rats. Reverse transcription–polymerase chain reaction and semiquantitative polymerase chain reaction analysis were used.

RESULTS: After photocoagulation, the mRNA expression of pigment epithelium–derived factor was upregulated in human retinal pigment epithelial cells at 6 hours and then gradually decreased. Compared with controls, significantly higher levels of pigment epithelium–derived factor were observed in rat retinas from 6 to 24 hours after laser photocoagulation (P < .005), and they were still higher than before photocoagulation at 2 weeks.


S CATTER PHOTOCOAGULATION INHIBITS RETINAL NEOVASCULARIZATION AND INDUCES REGRESSION OF NEOVASCULARIZATION, BUT THE MECHANISM OF THESE PHENOMENA IS NOT COMPLETELY UNDERSTOOD.

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Pigment epithelium–derived factor, a member of the serpin gene family, is a protein first isolated from human retinal pigment epithelial cells and reported as a neurotrophic factor.1 Pigment epithelium–derived factor was recently shown to be a potent inhibitor of ocular angiogenesis.2

We designed an experimental study on human retinal pigment epithelial cells in culture and on adult rats to determine whether laser photocoagulation altered the expression of pigment epithelium–derived factor. Human retinal pigment epithelial cells (ARPE-19 cell line) grown to confluence were photocoagulated (Coherent Radiation Model 900 krypton laser, Palo Alto, California; 0.1 second, 100 μm, 350 mW, 300 spots/3.5-cm diameter dish) as previously described.3 For the in vivo model, panretinal photocoagulation was performed on pigmented rats (0.05 second, 500 μm, 50 mW, 100 spots/eye). All procedures were conducted in accordance with the Association for Research in Vision and Ophthalmology statement for the use of animals.

After laser photocoagulation, the retinal pigment epithelial cells and sensory retinas were collected for mRNA isolation. Retinal pigment epithelial cells and retinas without photocoagulation served as control. Reverse transcription–polymerase chain reaction was performed as previously described.4 Semiquantitative polymerase chain reaction analysis was carried out by densitometry (National Institutes of Health imaging System) to determine the level of pigment epithelium–derived factor expression. β-actin was used as an internal control.

After photocoagulation, an upregulation of pigment epithelium–derived factor was observed in the human retinal pigment epithelial cells at 6 hours, after which the level of pigment epithelium–derived factor gradually declined. The level was 1.33 ± 0.03 (mean ± standard error) times higher than the control at 6 hours, 0.92 ± 0.02 at 24 hours, 0.77 ± 0.03 at 48 hours, and 0.59 ± 0.04 at 72 hours (Figure 1). All of these values were significantly different from the control level, P < .05 (one-way analysis of variance and Fisher test).

After photocoagulation of the adult rat retina, a higher level of pigment epithelium–derived factor was maintained from 6 hours to 24 hours after photocoagulation and then gradually decreased, but the level was still higher than that before photocoagulation at 2 weeks. Thus, the level was 27.4 ± 3.91 times higher than was the control at 6 hours, 33.0 ± 5.76 at 24 hours, 23.2 ± 9.10 at 3 days, 4.26 ± 0.51 at 1 week (P < .05), and 2.1 ± 0.76 at 2 weeks (Figure 2).

The upregulation of pigment epithelium–derived factor was transient in cultured human retinal pigment epithelial cells, but it was markedly higher in the rat retina and the higher levels were maintained for 2 weeks.

Pigment epithelium–derived factor has been reported to inhibit neovascularization in rat corneas and to inhibit migration of endothelial cells; pigment epithelium–de-
Derived factor was more effective than the angiogenesis inhibitors, agiostatin and endostatin. Photocoagulated retinal pigment epithelial cells and retinas have been shown to express higher levels of potent inhibitors of angiogenesis, and the higher levels of antiangiogenesis factors were suggested to explain the inhibition and the regression of neovascularization after photocoagulation. Because pigment epithelium–derived factor is also a powerful inhibitor of angiogenesis, pigment epithelium–derived factor can also be an important factor in the beneficial effects of photocoagulation.

REFERENCES

Hypotony Caused by Scleral Buckle Erosion in Marfan Syndrome

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PURPOSE: To describe hypotony caused by erosion of the conjunctiva and sclera by a silicone scleral buckle.

METHODS: Interventional case report. A 33-year-old man with Marfan syndrome presented with hypotony maculopathy and a collapsed globe 17 months after repair of retinal detachment with a silicone sponge and silicone encircling band.

RESULTS: Examination in the operating room revealed extrusion of the buckle through the conjunctiva and full-thickness scleral erosion. The silicone buckle was removed, and the scleral defect was closed with interrupted 8-0 nylon sutures. Postoperative glaucoma was treated with cyclophacoagulation. Eight months after scleral repair, visual acuity was 20/40, intraocular pressure was 10 mm Hg, and the retina was attached.

CONCLUSION: Full-thickness scleral erosion secondary to a silicone exoplant causing hypotony is a rare long-term complication in patients with thin sclera. (Am J Ophthalmol 2001;132:429–431. © 2001 by Elsevier Science Inc. All rights reserved.)

POSTOPERATIVE COMPLICATIONS AFTER SCLERAL BUCKLING procedures are well known and include glaucoma, anterior segment ischemia, infection, buckle extrusion or erosion, cystoid macular edema, macular pucker, and dioptria, among others.1 Hypotony is an uncommon clinical finding that is not a recognized long-term complication of scleral buckle placement. In general, an acute drop in intraocular pressure may result from retinal detachment, choroidal detachment, a cyclodialysis cleft, uveitis, a filtering procedure, a wound leak, or penetrating trauma. We report a case of ocular hypotony caused by full-thickness conjunctival and scleral erosion from a silicone scleral buckle.

• CASE: A 33-year-old pseudophakic man noted blurred vision in his right eye. Visual acuity was 2/200. Examination revealed an intraocular pressure of 42 mm Hg, a macula-off retinal detachment, and a dislocated posterior chamber intraocular lens RE. Supranafal subluxation of the crystalline lens LE and extensive lattice degeneration in both eyes were present. Marfan syndrome was suspected.

A scleral buckling procedure, pars plana vitrectomy, and removal of the dislocated intraocular lens were performed. Intraoperatively, areas of scleral thinning were noted temporally. A #4050 solid silicone encircling band (5 mm wide) and an inferonasal #507 silicone sponge (7.5 mm wide) were placed. Postoperatively, the retina remained attached. The diagnosis of Marfan syndrome was confirmed after systemic evaluation. One year postoperatively, best-corrected visual acuity was 20/40 and intraocular pressure was 10 mm Hg.

Seventeen months after repair of the retinal detachment, the patient reported a sudden, painless loss of vision in the right eye. He denied any history of trauma. Visual acuity was 4/200 with his aphakic contact lens and 20/70 with hyperopic refraction. Intraocular pressure was 1 mm Hg. Slit-lamp biomicroscopy revealed trace conjunctival injection and a deep anterior chamber with a few (1+) cells. Seidel testing was negative, and no exposure of the scleral buckle occurred. Gonioscopy did not reveal a cyclodialysis cleft. Ophthalmoscopy revealed dilated, tortuous retinal veins, a small intraretinal hemorrhage, and choroidal folds in the macula (Figure 1, top). The retina was attached, and the scleral buckle effect was visible. No erosion of the scleral buckle was appreciated. B-scan ultrasonography demonstrated diffuse choroidal thickening. Fluorescein angiography revealed diffuse macular and optic disk leakage (Figure 1, bottom). Hypotony maculopathy was diagnosed. Atropine sulfate 1% twice a day and prednisolone acetate 1% every hour were initiated.

Six days later, visual acuity was hand motions and intraocular pressure was 0 mm Hg. Examination revealed a collapsed globe. The limited view of the retina revealed scleral infolding. An open globe was suspected.

In the operating room, examination revealed an extruded silicone sponge inferonasally (Figure 2, top). A limited peritomy was performed, and the sponge was removed, revealing a full-thickness, 7 × 5 mm atrophic scleral hole with thinned edges and exposed, but intact, choroidal tissue (Figure 2, bottom). It was repaired using interrupted 8-0 nylon sutures. The loose encircling silicone band was removed. Postoperatively, the patient had residual vitreous hemorrhage that cleared spontaneously and