A CLINICOPATHOLOGICAL STUDY OF YAG LASER TRANSSCLERAL CYCLOPHOTOCOAGULATION

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Abstract : To our knowledge, there have been few clinicopathological reports of transscleral cyclophotocoagulation, especially in humans.

We conducted a clinicopathological study of an eye of a 58-year-old Japanese man who had undergone a transscleral YAG cyclophotocoagulation for rubeotic glaucoma. The patient developed a massive intraocular hemorrhage during the laser treatment. Two days later the patient underwent an enucleation of the blind, painful eye.

A light microscopic examination of the ciliary body revealed foci of destruction of the ciliary pigmented and nonpigmented epithelium, and intact ciliary muscle. Although selective destruction of the ciliary epithelium had been achieved, numerous foci of hemorrhage from the anterior to the posterior portions of the intraocular structure probably complicated postoperative clinical course. These hemorrhages may have resulted from a too intense setting of the laser power.

This study indicates that treatment parameters of transscleral cyclophotocoagulation should be individualized for each patient, depending on the thickness of the sclera and color of the uvea.

Key words : YAG laser, transscleral photocoagulation, glaucoma therapy, ciliary body pathology

INTRODUCTION

YAG laser transscleral photocoagulation has been used as a useful clinical tool to treat recalcitrant elevations of intraocular pressure[1-8]. To our knowledge, there have been few clinicopathological reports of YAG laser transscleral cyclophotocoagulation. We present a Japanese case that showed acute histopathological changes after YAG laser transscleral cyclophotocoagulation.

PATIENTS AND METHODS

A 58-year-old Japanese man was referred to the Nara Prefectural Mimuro Hospital with a sudden visual loss of the right eye on April 6, 1994. His visual acuity was light perception OD and 14/20(20/20×S+0.5D C-0.75D AX90°) OS. The intraocular pressure(IOP) was 18 mmHg OD and 17 mmHg OS. Slit-lamp examination of the anterior segment including cornea, anterior chamber, and angle, was unremarkable in each eye.

Funduscopy of the right eye revealed a dense vitreous hemorrhage. The retina was not visualized. The left eye had an unremarkable funduscopic appearance except for two foci of lattice degeneration, at 1 and 5 o'clock. A and B scan echography of the right eye revealed

a flat serous retinal detachment in the posterior pole. Electroretinogram (ERG) of the right eye showed markedly decreased amplitude, with no detectable wave elements.

Phacoemulsification, posterior chamber intraocular lens implantation, vitrectomy, fluid-gas exchange, and scleral buckling (encircling) of the right eye were performed on April 18, 1994. The definite origin of the intraocular hemorrhage was not clear, with some subretinal hemorrhage observed in the posterior pole. Several iatrogenic retinal tears were treated with a diode laser endophotocoagulation intraoperatively.

Postoperatively the fundus of the right eye was not visualized due to a persistent vitreous hemorrhage thereafter. On August 9, 1994, rubeosis of the iris was noted in the right eye. The visual acuity of the right eye was light perception with the intraocular pressure 6 mmHg. The intraocular lens had been properly fixed in the bag. The fundus was still not visualized due to the persistent vitreous hemorrhage.

The patient was lost to follow-up until February 1, 1995, when the vision of the right eye was zero (no light perception). The intraocular pressure was 9 mmHg. Rubeosis of the iris appeared to have increased. The fundus was not visualized. Mild hyphema was noted on March 29, which was also observed on his following visits on May 31 and September 5, when other findings including vision, IOP, posterior chamber, and fundus visibility were similar. The left eye was stable. A and B scan echography of the right eye was not taken during this period.

On October 25, 1995, the patient presented with a sudden ocular pain.

The IOP was 50 mmHg OD and 17 mmHg OS. Marked corneal edema, iris rubeosis, and massive blood coagula in the anterior chamber were noted. The angle was not clearly visualized.

A YAG laser transscleral cyclophotocoagulation (Model 6000, Laser Sonics, U.S.A.) was performed on the same day. The laser intensity was 7J. A row of laser spots was placed at 1.5mm from the limbus circumferentially. A massive hemorrhage was noted in the anterior chamber intraoperatively.

The intraocular pressure of the right eye did not decrease postoperatively. As of October 27, the IOP was 40 mmHg OD. The anterior chamber became filled with blood. The patient desired to undergo enucleation of the painful, blind eye. An enucleation of the eye was performed on the same day. The eye was immediately fixed in a 10% formaldehyde solution.

RESULTS

(Gross findings)

The globe measured 24×24×26 mm with a 4 mm optic nerve attached. The cornea was hazy and measured 12×11 mm. Transillumination revealed marked reduction of light. The eye was opened by removal of the superior cap. Intraocular examination revealed a funnel-shaped whitish tissue in the vitreous cavity with an extensive intraocular hemorrhage. The globe was processed for a light microscopic study after removal of the inferior cap.

(Microscopic findings)

Examination of the cornea revealed mild inter and intracellular edema of the basal cells of the epithelium. The stroma was unremarkable. The endothelium was slightly attenuated with

14 endothelial cell nuclei per high power field.

The anterior chamber angle was closed with a thin fibrovascular membrane, which extended onto the anterior aspect of the iris. The iris had several small foci of hemorrhage and mild chronic inflammatory cell infiltration in the stroma.

Several foci of anterior synechia were present.

The ciliary body had areas of hemorrhage and destruction of the ciliary pigmented and

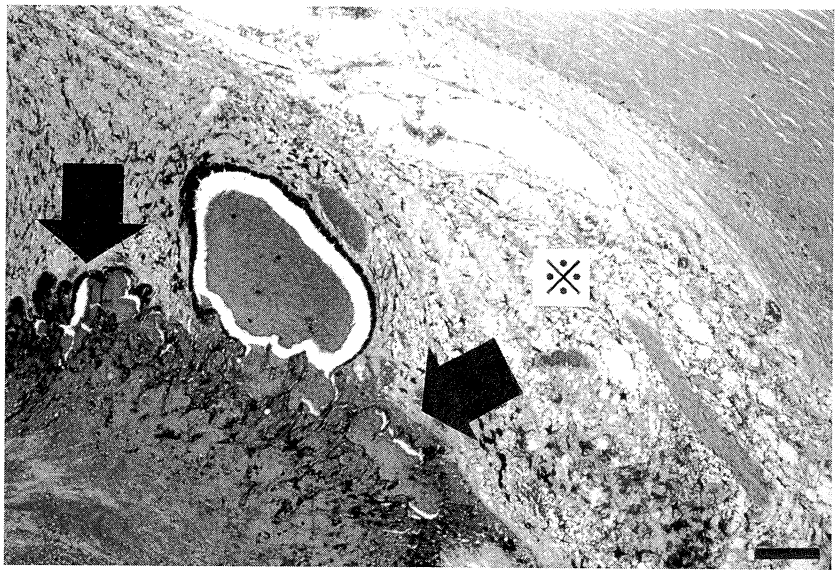

Fig. 1. The ciliary body. The stroma has foci of edema (asterisk) with mild acute and chronic inflammatory cell infiltration. Arrows show destruction of the ciliary epithelium with dissemination of pigment and hemorrhage. Hematoxylin & Eosin, Bar=250㎛

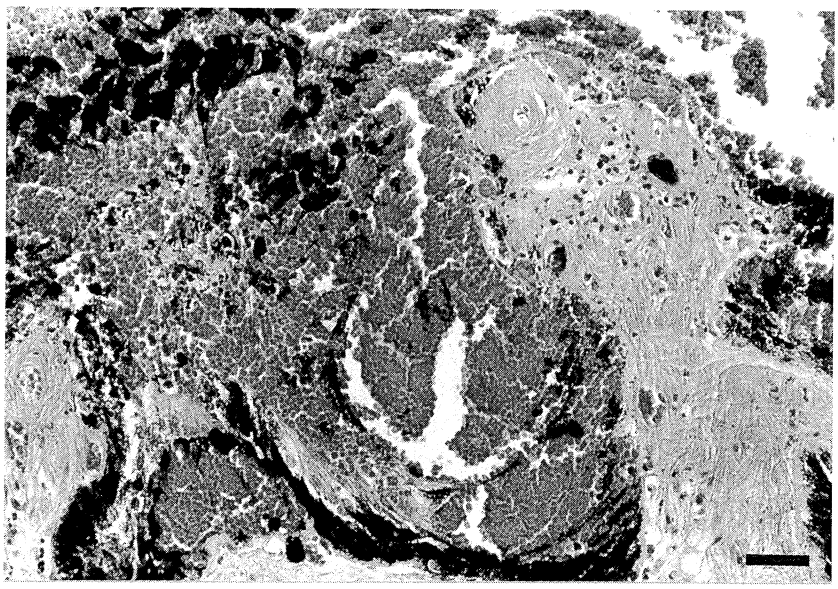

Fig. 2. Fig.2. The pars plicata of the ciliary body. Destruction of the ciliary epithelium is present. Hematoxylin&Eosin,Bar=100㎛

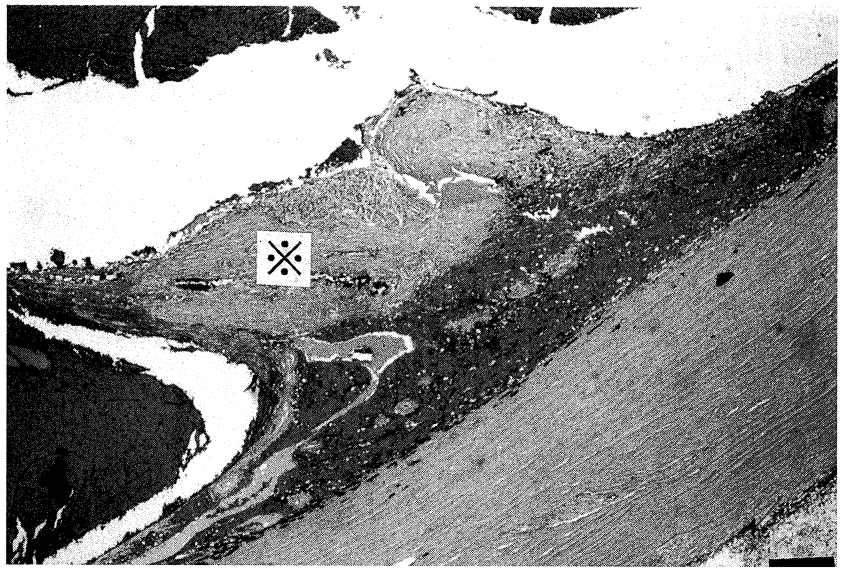

Fig. 3. The posterior pole. A large subretinal fibrovascular tissue is present (asterisk), with overlying atrophic retina. The underlying choroid show engorged vessels and extensive hemorrhage. Hematoxylin&Eosin, Bar=250μm

non-pigmented epithelium (Figs.1, 2). A ciliochoroidal effusion with a moderate acute and chronic inflammatory cell infiltration was present. The ciliary muscle was intact except for several areas of hemorrhage and edema.

Small fragments of lens remnant were present. The retina was totally detached with marked gliosis and continuous with an extensive anterior cyclitic membrane. A large subretinal neovascular plaque, with foci of vascular channels running through breaks of Bruch's membrane, was present in the posterior pole (Fig. 3). The choroid had several large foci of hemorrhage. Despite the past history, cross-sections of the optic nerve had fairly-preserved nerve fibers with several small foci of hemorrhage. The sclera and episclera were unremarkable except for mild acute and chronic inflammatory cell infiltration.

DISCUSSION

YAG laser transscleral cyclophotocoagulation has become a useful clinical tool to treat recalcitrant elevations of intraocular pressure. As this method has become widely used, several side effects, including choroidal detachment, flat anterior chamber, hypotony[9], sympathetic ophthalmia[10], phthisis, and hyphema[8], have been observed. Although this laser has been shown to be able to selectively destruct the ciliary epithelium, mild to severe destruction of the adjacent tissue may occur[1-6, 9-11]. In a recent report by Myers[12], it was demonstrated that three to five percent of laser power delivered during cyclophotocoagulation reaches the posterior pole.

In the present case, the initial vitreous hemorrhage was probably due to an intraocular evacuation of blood that originated from a rupture of the subretinal neovascular plaque. A

persistent hemorrhage from the vascular plaque probably hampered the postoperative healing course and led to the development of the proliferative vitreoretinopathy and neovascular glaucoma. A YAG laser cyclophotocoagulation was performed to reduce the intraocular pressure. Histologically the ciliary pigmented and nonpigmented epithelium was successfully destroyed in some areas. The ciliary muscle was intact. The vessels in the ciliary stroma, that had been markedly engorged, probably had markedly thinned vascular walls. They might have been broken by weak second waves of the laser. The hemorrhage might have been widely disseminated and led to intense hyphema. Intense hemorrhage around the pars plicata probably supports this speculation. However, we cannot exclude the possibility that the postoperative intraocular hemorrhage was derived from the subretinal neovascular membrane, since the laser energy could reach the posterior pole[12]. We could not draw a definite conclusion about the cause of the massive intraocular hemorrhage from available sections.

Clinicopathological reports of the eyes after YAG laser transscleral photocoagulation are rare[10, 11]. Histopathological studies in human eyes[4, 5], autopsy eyes[2, 3, 6], and rabbit eyes[1, 6, 13-15] have been done to find appropriate condition of the laser treatment. However, the most effective and safe condition has not been completely established.

If this hemorrhage was due to YAG laser transscleral photocoagulation, the cause of the hemorrhage may have been too intense photocoagulation for the patient. A study[11] showed that energy levels ranging from 4.4 to 5.6J were effective in producing appropriate lesions. In the present case, the recommended treatment condition of the laser was 7J, which was employed in the treatment. The optimal condition for Japanese brown eyes has not been clearly determined. Lower energy levels may be more appropriate in some patients. Although the ciliary pigmented and nonpigmented epithelium was successfully destroyed in the present case, we will have to accumulate experience to find the optimal laser intensity in various eye conditions of Japanese brown eyes.

Transscleral YAG cyclophotocoagulation is a very useful clinical tool, but we have to bear in mind this possible complication (hemorrhage) and determine the optimal treatment condition to each patient.

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