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Three-port lens-sparing vitrectomy for aggressive posterior retinopathy of prematurity: Early surgery before tractional retinal detachment appearance

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PURPOSE. *Aggressive posterior retinopathy of prematurity (APROP) may suddenly develop into tractional retinal detachment (TRD), often resulting in poor vision if untreated. The aim of the current study is to examine the anatomic results and complications of lens-sparing vitrectomy (LSV) for stage 3 APROP, before TRD appearance.*

METHODS. *A retrospective, noncomparative, consecutive case series of 13 eyes of 9 patients (mean gestational age 24.1±0.9 weeks [range: 23-25 weeks], mean birthweight of 725.8±107.9 grams [range: 598-897 grams]) with stage 3 APROP was carried out. The eyes did not respond to at least one session of retinal laser photocoagulation, showing signs of disease progression. All eyes underwent 20-gauge LSV before retinal detachment appearance.*

RESULTS. *All eyes underwent 20-gauge three-port LSV and intraoperative additional laser photocoagulation. At the end of the surgery, five eyes were tamponaded with air; in eight eyes, a balanced salt solution was left in the vitreous cavity. After 13.5±5.3 months of follow-up (range: 4-22), the retina was completely attached in all eyes, without any signs of progression. The authors did not observe any intraoperative or postoperative complications.*

CONCLUSIONS. *Surgical approach to stage 3 APROP refractory to laser photocoagulation could be effective and safe in order to avoid the progression of the disease. (Eur J Ophthalmol 2007; 17: 785-9)*

KEY WORDS. *Aggressive posterior ROP, Laser photocoagulation, Vitrectomy*

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INTRODUCTION

The International Classification of Retinopathy of Prematurity (ICROP) was revised in 2005 to include a more aggressive form of ROP observed in the smallest infants (aggressive posterior ROP [APROP]) (1). It is defined as an uncommon, rapidly progressive form of ROP, usually observed in Zone I or in the posterior Zone II, characterized by fibrovascular proliferation on the surface of the retina. If untreated, it rapidly progresses to tractional retinal detachment (TRD) without following conventional steps 1 to 5. If it is not recognized and treated quickly, the prognosis is very poor, with severe visual loss when a TRD is established (2-4). Standard treatments, such as retinal photocoagulation or cryopexy, are sometimes but not always effective for stabilizing APROP (5-7) and avoiding progression to TRD. Previous studies suggested that lens-sparing vitrectomy (LSV) might be more effective in treatment of early stages of TRD (8-10). The aim of our study is to determine the efficacy of early LSV in eyes with stage 3 APROP refractory to laser photocoagulation.

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METHODS

A consecutive series of 13 consecutive eyes of nine children diagnosed with stage 3 APROP was retrospectively reviewed. The patients were born at a mean gestational age of 24.1±0.9 weeks (range: 23-25 weeks) with mean birthweight of 725.8±107.9 grams (range: 598-897 grams). Laser photocoagulation after clinical diagnosis was densely performed by a single experienced operator (T.M.F.). He judged it an adequate treatment, but the eyes were still showing signs of progression of the disease: an increasing dilatation and tortuosity of the vessels at the posterior pole and the arising and extension of the flat network of neovascularization towards the posterior lens surface were detected by multiple observers (T.M.F., C.F., L.S., R.D., G.B.) by indirect ophthalmoscopy. These findings were the inclusion criteria of the study. All eyes underwent three-port LSV as soon as possible, using the Oculus BIOM wide-angle viewing system, by a single experienced surgeon (T.M.F.). Twenty-gauge sclerotomy was made, after conjunctival peritomy, 1 mm posterior to the limbus, through the pars plicata, then a 2.5 mm infusion cannula was inserted into the inferotemporal sclerotomy and fixed in place by a 7.0 Vicryl suture, previously placed. A 20-gauge vitreous cutter and endoilluminator were used to perform a core vitrectomy, removing as much posterior vitreous as possible without inducing a posterior vitreous detachment (PVD). The surgeon did not attempt to induce PVD and to dissect adhesions from the ridge tissue; vitrectomy was not performed over the peripheral retina previously treated with photocoagulation. Intraoperative additional laser photocoagulation was performed in all eyes, because the surgeon thought that it was necessary. Five eyes were endotamponaded with air, because of the possible risk of early postoperative intraocular bleeding, while in eight eyes a balanced salt solution was infused. At the end of surgery sclerotomies were closed by 7.0 adsorbable Vicryl suture, conjunctival peritomy by 8.0 adsorbable Vicryl suture, and no postoperative positioning was required. The operating surgeon (T.M.F.) and collaborators (C.F., L.S., R.D., G.B.) determined the postoperative status performing indirect ophthalmoscopy with 28 D Volk lens on the first postoperative day, the first and second weeks, and the first, second, and third month, and then every 3 months, either during an office examination or during a subsequent examination under anesthesia when an adequate office examination was not possible. They evaluated the vascular activity, the anatomic status of the retina, and eventual complications.

RESULTS

Demographic data are summarized in Table I. Indirect argon green laser photocoagulation was performed from the sixth to the ninth week of chronologic age, when the initial signs of APROP, such as increased dilatation and tortuosity of the vessels at the posterior pole and the arising and extension of the flat network of neovascularization towards the posterior lens surface, were detected. Both nonvascularized and vascularized retina showing marked vessel shunts were treated using laser spots of 300 to 450 mW power and 200 to 400 ms duration. The treatment was repeated during a mean period of 7.8±2.2 weeks (range: 4-11 weeks), but retinal vessels dilatation and tortuosity, shunts, and fibrovascular tissue increased.

TABLE I - DEMOGRAPHIC DATA

Patient	Eye	Gestational age (wk)	Birthweight (g)	Duration of laser treatment (d)	Age at surgery (wk)	Follow-up (mo)
1	R	24	654	7	38	4
2	Both	24	632	7	35	22
3	L	25	795	14	40	15
4	Both	23	627	7	36	13
5	Both	23	810	9	37	17
6	R	25	897	11	40	8
7	Both	23	598	14	38	16
8	R	25	829	8	39	11
9	R	25	690	14	40	16

Duration of laser treatment is the period during which indirect laser photocoagulation was performed

Surgery was performed at 38.1±1.8 weeks (range: 35-40 weeks) weeks of chronological age. During surgery, vitreous hemorrhage was observed from fibrovascular tissue, easily managed by the surgeon, and no iatrogenic retinal tears were observed. At the end of surgery, the retina was attached in all eyes and no vitreous bleeding was observed. At the end of follow-up (mean: 13.5±5.3 months, range: 4-22) no eye showed any signs of disease progression, such as increased dilatation and tortuosity of retinal vessels and arising of fibrovascular tissue, and the retina was totally attached in all patients. We observed that operated eyes became vascularly quiet after the second week. We did not observe any increase in intraocular pressure, even transient, lens opacities, endophthalmitis, rhegmatogenous retinal detachment, or neovascular glaucoma.

DISCUSSION

An early diagnosis of posterior ROP and complete laser photocoagulation of nonvascularized retina, eventually associated with early retreatments, are sometimes effective to stabilize the pathology (5-7). Despite those treatments, some cases have unfavorable history, progressing to TRD. There are many treatment options for ROP-associated retinal detachments, including scleral buckle (11-20), vitrectomy with lensectomy with or without scleral buckling (19-26, 30), and LSV (8-10, 27-30). In our case series, LSV alone is the chosen procedure in treating stage 4 and 5 ROP. The anatomic rate of success after LSV is more than 90% (9, 10, 29), significantly higher then that of scleral buckle (approximately 60%) (16, 17), sometimes also accompanied by functional success (8). Avoiding the use of scleral buckle preserves the infant from some procedure-related complications, such as anisometropia, amblyopia, and the need to remove or divide the buckle to allow normal ocular growth (31). Lensectomy enables the removal of the vitreous gel from the vitreous base, but sparing the native lens prevents deprivation amblyopia, permitting normal visual system development (27, 32). Some authors have suggested that infusion cannula may induce iatrogenic damage to the lens because of direct contact or by hydrostatic forces from the infusion stream (27); other authors agree with this hypothesis, but without significant results in their series (33).

APROP develops quickly to TRD, not following the classical scale 1 to 5. Because of this characteristic, it is common to face a stage 3 APROP that suddenly evolves to stage 5 TRD. Even if many authors found LSV effective to achieve a complete retinal reattachment, the efficacy of this technique is strongly associated with the retinal detachment stage. While LSV obtains good anatomic and functional results in stage 4A, it is slightly less effective in stage 4B (10) and it is associated with poor anatomic and functional outcomes in stage 5 ROP (21, 22, 24, 34).

In no case of our case series was TRD present, but there was a strong belief that the disease may progress soon to retinal detachment even if, when laser photocoagulation was performed, we though that the retina was lasered enough. In all eyes additional laser photocoagulation was performed, because the surgeon noticed that there were small areas not photocoagulated. There is no evidence whether the disease progression blocking is due to the vitrectomy or to the additional intraoperative laser photocoagulation, but our belief is that the laser-free areas were too small to be the cause of laser therapy failure. The removal of the posterior and central vitreous gel reduced the tractional forces of the fibrovascular tissue, and it also results in the suppression of new vessels growth, which is activated by the traction (14-17). We did not decide to remove all the fibrovascular tissue from the posterior retinal surface, in order to avoid the risk of severe intraoperative and early postoperative bleeding, considering it enough to remove the vitreous scaffold to avoid the progression to TRD.

Removing peripheral vitreous could result in increased risk of producing iatrogenic retinal tears, which often need an ocular endotamponade and postoperative positioning, and often lead to final anatomic failure (10). We did not observe any retinal tear intraoperatively or postoperatively, and no retinal detachment during the follow-up. Performing vitrectomy without the appearance of retinal tears or retinal detachment could avoid practicing more complicated surgical procedures such as complete peripheral vitrectomy or scleral buckling. Therefore, choosing to not remove all the vitreous preserves the lens from direct mechanical damage by contact with the endo-ocular instruments. We did not even observe any lens injuries from the infusion cannula. Sparing the lens was not a cause of failure in our experience, as shown in a recent case series in which vitrectomy with lensectomy seems to be more effective to achieve final retinal attachment (30). Peripheral vitreous and posterior lens surface could be the places where fibrovascular tissue could arise. Sparing the lens and peripheral vitreous could result in arising and con-

tracting of fibrovascular tissue in those areas, possibly the reason for LSV failure in Azuma et al (30). On the other hand, we valued the importance of sparing the native lens to prevent amblyopia and, in itinera, we did not find that sparing the lens represents a cause of surgery failure. One hypothesis of the lack of fibrovascular tissue growing in not vitrectomized areas is that they were previously well-lasered.

We did not observe any complications such as neovascular glaucoma or endophthalmitis, which in the literature seem to have the same incidence in pars plana vitrectomy to treat rhegmatogenous retinal detachment (8, 9, 24, 27, 28, 35-38).

On the other hand, peripheral vitreous and posterior lens surface could be the places where fibrovascular tissue arises. Sparing the lens and peripheral vitreous could result in arising and contracting of fibrovascular tissue in those areas (30).

There are some limitations in our study. The study is non-randomized, uncontrolled, and not prospective. The cohort size is relatively small and the follow-up period is relatively short (mean: 13.5±5.3 months [range: 4-22]). We did not perform any visual acuity test. Further follow-up is needed to determine long-term success of our approach and further studies are needed to define the exact timing of surgery, and the role of antiangiogenic drugs alone or in association with surgery to treat this disease.

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