TRIAMCINOLONE-ASSISTED PARS PLANA VITRECTOMY FOR PROLIFERATIVE VITREORETINOPATHY

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Purpose: To determine whether triamcinolone acetonide (TAAC) staining facilitates posterior hyaloid and epiretinal membrane (ERM) removal in patients undergoing pars plana vitrectomy (PPV) for rhegmatogenous retinal detachment (RRD) with proliferative vitreoretinopathy (PVR).

Methods: Ten consecutive pseudophakic patients (10 eyes) underwent PPV for RRD with PVR. After a core PPV, a few drops of a commercially available TAAC aqueous suspension (40 mg/mL) with vehicle were injected into the mid vitreous cavity to visualize the posterior hyaloid, thus allowing a complete posterior hyaloidectomy. Next, 0.1 to 0.2 mL of TAAC was applied on the retinal surface to visualize and peel the ERMs. The tamponading agent was silicone oil (1,300 cs) in eight eyes and perfluoropropane (C_3F_8 14%) in two eyes. The minimal follow-up period in all patients was 4 months.

Results: In all patients, intraoperative staining with TAAC consistently improved direct visualization and delineation of the posterior hyaloid and ERMs and facilitated their removal. No adverse reaction related to the use of TAAC was observed immediately postoperatively or 4 months after surgery.

Conclusions: Intravitreal TAAC may be an important adjuvant tool in the delineation of posterior hyaloid and ERMs, allowing for a more complete and safer ERM removal in the surgical management of PVR complicating RRD. It is well tolerated with all its vehicle if used at low concentration and rapidly removed during surgery.

RETINA 23:771–776, 2003

Proliferative vitreoretinopathy (PVR) is characterized by the proliferation and contraction of nonvascular epiretinal membranes (ERMs) at the vitreoretinal interface often after a rhegmatogenous retinal detachment (RRD). It is the most common cause of failure of RRD surgery, causing recurrent RRDs in 5% to 10% of eyes.[1] Incomplete ERM removal often leads to the failure of surgery even if long-acting tamponading agents, such as perfluropropane or silicone oil, are used. For this reason, complete ERM visualization and delineation, favoring a more complete removal, is the first step for an increased long-term retinal reattachment.[2] Peyman et al[3] first described the use of intravitreal triamcinolone acetonide (TAAC) as an aid to visualize the vitreous and posterior hyaloid during pars plana vitrectomy (PPV). Sakamoto et al[4] used TAAC to improve the visibility of hyaloid during PPV in patients with proliferative vitreoretinopathy, diabetic macular edema, or proliferative diabetic retinopathy. Nevertheless, they did not describe in details the use of TAAC in removing ERM complicating RRD.

The purpose of the present clinical study was to

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The authors have no proprietary interest in the materials mentioned in this article.

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report on our experience using TAAC to facilitate visualization and delineation of posterior hyaloid and ERMs in RRD surgery complicated by PVR.

Methods

Ten eyes of 10 consecutive pseudophakic patients (six women and four men) with PVR (stage C2 or more) and RRD underwent vitreoretinal surgery using commercially available TAAC (Kenacort 40 mg/mL; Bristol-Myers Squibb, Princeton, NJ) to assist in visualization of posterior hyaloid and ERMs. Phakic patients with clear lenses were excluded to avoid cataract development. Aphakic patients were excluded to avoid a hypopyonlike condition caused by anterior chamber deposition of TAAC.[5,6] All procedures were performed by the same surgeon (T.M.F.) at the Department of Ophthalmology and Otolaryngology of the University of Bari in Bari, Italy. All patients signed an informed consent.

Preoperative anesthesia was obtained using 4 mL of sub-Tenon's block (mixture 50:50 of lidocaine 2% and bupivacaine chloridrate 0.5%). All procedures were performed under wide-angle viewing conditions (EIBOS wide-angle viewing system; Haag-Streit, Wedel, Germany). After a standard three-port pars plana core vitrectomy, 0.1 mL of TAAC aqueous suspension (40 mg/mL) was injected in the mid vitreous cavity through a blunt-tipped needle until it became trapped in the gel structure of the vitreous. We did not divide the vehicle from the aqueous suspension of TAAC. Surgical separation of the posterior hyaloid from the optic disk and posterior retina was performed when a posterior vitreous detachment was not complete, removing all vitreous islands left on the retina. With the infusion cannula clamped, 0.1 to 0.2 mL of TAAC was injected over the retinal surface, ERM site, and peripheral vitreous to achieve thorough membrane removal. Afterward, TAAC in excess was aspired using a backflush needle. We did not make particular efforts to remove residual TAAC particles left in the vitreous cavity. A vitreous base shaving was then performed. Several milliliters of perfluorodecalin were injected to flatten the retina. Then, an intraocular forceps was used to remove the ERM marked by the TAAC. In each patient, ERM peeling was performed until no residual membranes could be clearly observed. A complete fluid–air exchange was performed in all the patients. All the eyes underwent endolaser photocoagulation of retinal breaks. Air–perfluropropane (C_3F_8 14%) exchange was performed in two patients, and air–silicone oil exchange (1,300 cs) was performed in eight patients. A postoperative face-down position was required in all patients at least for 2 days.

Final visual acuity, intraocular pressure (IOP), and fundus biomicroscopy were examined at baseline and at 1 day, 1 week, 1 month, and 4 months after surgery. Intraocular inflammation was subjectively evaluated by slit-lamp biomicroscopy in a scale ranging between 0 for no flare and 5 for maximal flare.

Results

Diagnoses, surgical techniques, and outcomes are described in Table 1. In all 10 cases, the posterior hyaloid was well visualized and easily separated from the retina by aspiration of the vitrectomy probe. The posterior hyaloid became well visualized as a thin, white surface because of the contrast between the waving posterior vitreous cortex covered and stained by TAAC-entrapped particles and the fluid-filled posterior hyaloid space.

In five eyes after surgically induced posterior vitreous detachment, small islands of posterior hyaloid were found left on the retina and were completely removed using vitreal forceps. Triamcinolone acetonide visualized the vitreous base and enabled its complete shaving. In the same way, TAAC visualized entirely the ERMs by showing clear contrast with unstained retina. These differences were intensified by the gentle aspiration of the vitrectomy probe or by the forceps movements.

All the eyes tamponaded with silicone oil underwent its removal 3 months after initial surgery. At the end of the fourth month of follow-up, the retina was attached in 9 (90%) of the 10 patients; only in one eye did a retinal redetachment occur as a result of the presence of an unrecognized peripheral open tear. No residual or recurrent ERM was detected in any of our patients.

The mean preoperative visual acuity (Figure 1) was 1.3 ± 0.5 logMAR (range, 0.3–2). The mean postoperative visual acuity at the end of the follow-up period was 0.81 ± 0.43 logMAR (range, 3–0.3) and was not significantly different from preoperative values (P = 0.5, t-test).

The mean preoperative IOP (Figure 2) was 12.6 ± 2.7 mmHg (range, 8–16 mmHg). The mean IOP, 4 months postoperatively, was 18.5 ± 3.8 mmHg (range, 14–25 mmHg), with an average increase of 5.9 ± 3.7 mmHg (range, 0–11 mmHg) from the baseline level (P = 0.0009, t-test).

In four eyes, on the day after surgery, a few small TAAC granules were seen in the lower half of the fundus, but they disappeared by the third day after surgery. No retinal toxicity was found in any eye, and no eye had a postoperative anterior chamber flare or cellular reaction exceeding 2+ nor granules of TAAC.

Table 1. Characteristics and Outcomes of Patients

Patient	Indication for Surgery	Tamponading Agent	PVR Stage*	Preoperative Visual Acuity (logMAR)	Postoperative Visual Acuity (logMAR)	Preoperative IOP (mmHg)	Postoperative IOP (mmHg)	Status of Retina at the End of Follow-up
1	RRD + PVR	Silicone oil	C2	2	3	8	19	Detached
2	RRD + PVR	C_3F_8 14%	C2	0.3	1.2	16	25	Attached
3	RRD + PVR	C_3F_8 14%	C2	1	0.3	10	15	Attached
4	RRD + PVR	Silicone oil	C3	1.2	0.3	12	20	Attached
5	RRD + PVR	Silicone oil	C2	1.2	1.2	13	24	Attached
6	RRD + PVR	Silicone oil	C3	2	1.2	12	17	Attached
7	RRD + PVR	Silicone oil	C3	2	1.2	12	15	Attached
8	RRD + PVR	Silicone oil	C2	1.1	1	16	20	Attached
9	RRD + PVR	Silicone oil	C2	1	0.3	16	16	Attached
10	RRD + PVR	Silicone oil	C2	1.1	1	11	14	Attached

* As classified by the Retina Society Terminology Committee. The classification of retinal detachment with proliferative vitreoretinopathy. Ophthalmology 1983;90:121–125.
PVR, proliferative vitreoretinopathy; IOP, intraocular pressure; RRD, rhegmatogenous retinal detachment.

Discussion

Triamcinolone acetonide is a water-insoluble steroid that suppresses intraocular inflammation by reducing inflammatory exudation and inhibiting proliferation of fibroblast and formation of granulation tissue. Its antiinflammatory effect can last for 3 months because of its longer clearance time compared with that of water-soluble steroids.[7–9] It has been

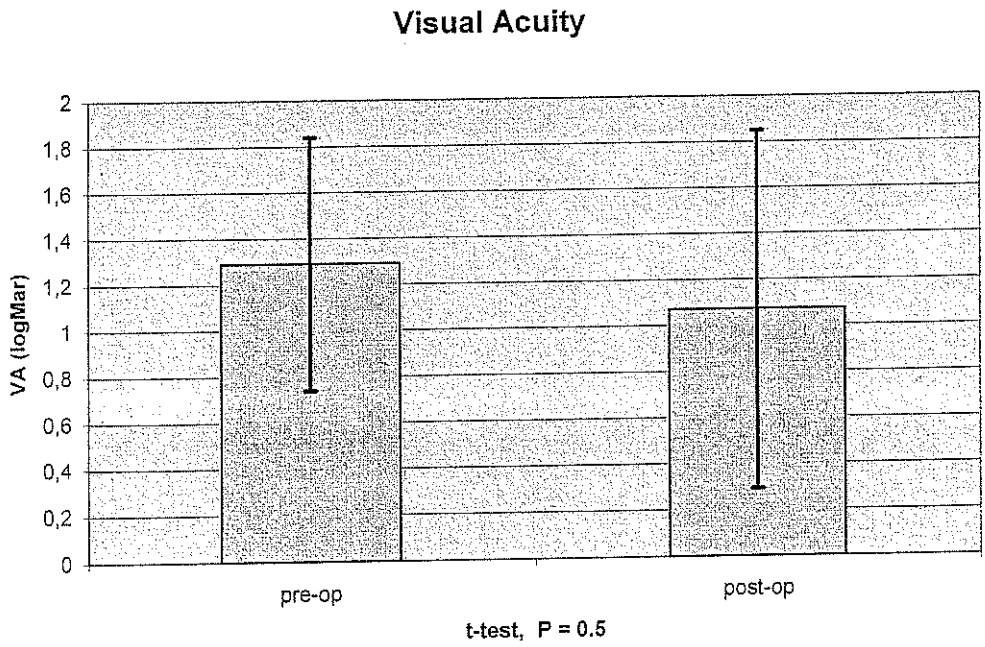

Fig. 1. The mean preoperative and postoperative visual acuity after 4 months of follow-up. The difference is not statistically significant (P = 0.5, t-test).

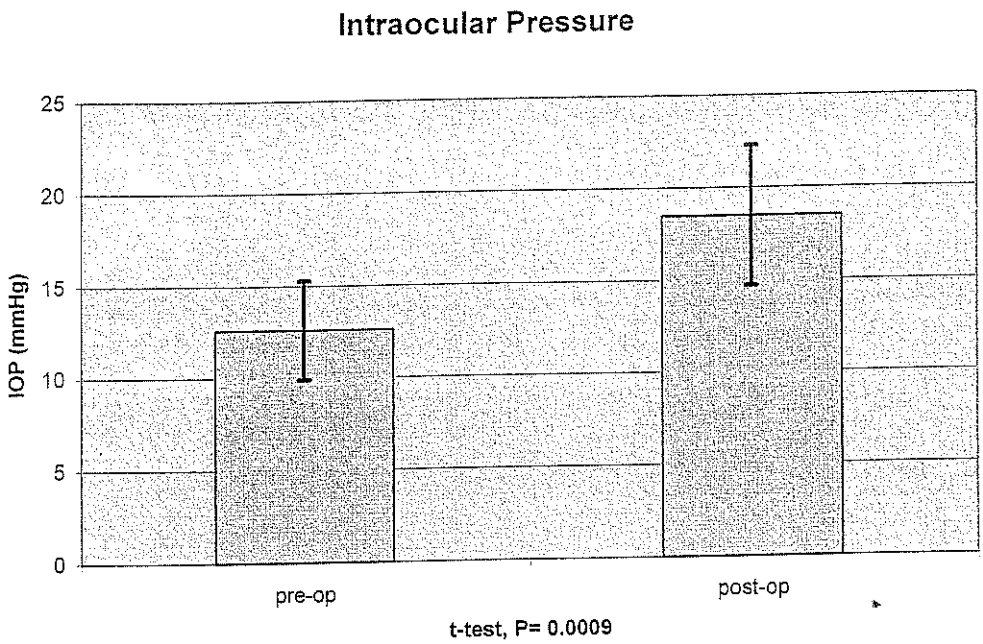

Fig. 2. The mean preoperative and postoperative intraocular pressure after 4 months of follow-up. The difference is statistically significant ($P = 0.0009$, t-test).

shown to be effective in reducing the progression and preventing the intraocular proliferation in animal models of PVR.[10,11] It has been reported that intravitreal TAAC reduce postoperative intraocular inflammation and the incidence of PVR after vitrectomy.[6] It is also known that intravitreal TAAC prevents fibrin syndrome.[3] Recently, intraocular injections of TAAC have been used in age-related macular degeneration and diabetic macular edema and as an adjuvant therapy of PVR and proliferative diabetic vitreoretinopathy without adverse effect on vision.[3–5,10–14]

Proliferative vitreoretinopathy is the most common cause of RRD surgery failure and is responsible for recurrent retinal detachments in 5% to 10% of eyes.[1] In surgical repair of RRD complicated with PVR, the major goals are the removal of vitreous scaffolding and tractional membranes. Removal of ERMs is the most important prognostic factor influencing the outcome of PVR surgery.[15–17] Complete posterior hyaloid and ERM visualization and delineation is the first step for their more complete removal and for an increased long-term retinal reattachment.[2] Inadequate visualization of the posterior vitreous cortex and peripheral vitreous may allow the surgeon to miss vitreous gel and to perform inadequate movements and excessive aspiration, which may cause complications. Ryan et al[18] used intravitreal autologous blood to identify cortical vitreous in macular hole surgery. However, blood as an aid to visualization of vitreous and posterior hyaloid has some complications, such as difficult dispersion in the vitreous cavity, a masquerading effect during surgical procedure, and the potential for inducing postoperative inflammation and PVR.[3]

Peyman et al[3] described the use of intravitreal TAAC as an aid to visualize the vitreous and thus assist in the separation of the posterior hyaloid during PPV. Their report stressed good vitreous visualization, the absence of retinal toxicity, and the possibility of preventing fibrin syndrome and PVR after surgery.[3] Sakamoto et al[4] used TAAC to improve the visibility of the hyaloid during PPV in 13 eyes with PVR with favorable anatomic and functional results. They found a significantly lower postoperative increase in laser flare in the eyes treated with TAAC-assisted PPV than in those treated without TAAC. However, they did not mention the advantages TAAC offers in visualizing the vitreous base and delineating ERMs.

We agree with these authors in that TAAC improves translucent membrane visualization, increasing the safety and rapidity of the surgical procedure. In TAAC-assisted PPV, TAAC suspension particles are trapped in the vitreous, standing out in contrast to a free-floating suspension of particles in infusion fluid and providing a good visualization of residual vitreous.[3] A clear visualization of the posterior hyaloid permits to set a low suction pressure, easily identify the posterior hyaloid separation, and start the posterior hyaloid separation anywhere the posterior hyaloid break is seen.[4] Moreover, TAAC suspension particles trapped in the peripheral vitreous enable a clear visualization of the vitreous base, permitting its complete removal.

Often, ERMs are poorly visible, and their presence

can be indirectly detected by the mild sheen or atypical wrinkling of underlying retina. Furthermore, when they are well visible, their extension may be greater than their ophthalmoscopic appearance.

Feron et al[19] and Li et al[20] performed the visualization of ERMs using a 0.06% trypan blue solution during PPV without adverse reactions up to 3 months after surgery. In an unpublished report, a double staining technique with trypan blue and indocyanine green proved useful in patients with idiopathic epimacular fibrosis (Stalmans P, 2001).[19]

The advantage of TAAC with respect to the staining techniques described earlier are the visualization of the vitreous gel and posterior hyaloid and its antiinflammatory effect. We did not observe any relevant postoperative complications in terms of retinal toxicity. We have injected TAAC without separating it from its vehicle, differently from previously published reports, without transient or prolonged adverse effects. A previous animal study proved TAAC to be nontoxic to the retina.[9] No study has found so far a direct toxicity of TAAC in doses of 2 to 20 mg in vitrectomized and nonvitrectomized eyes.[5,6,9,14,21–25] In experimental investigation, Hida et al[26] hypothesized that the vehicle of commercially available depot corticosteroids, and not the crystalline itself, could be toxic to intraocular tissue. The absence of toxic effects of commercially available TAAC in our series may be explained by the low dose injected and by the fast removal of TAAC from the vitreous cavity. The same reason could explain why we have not encountered pathologically increased IOP, which is one of the most stressed postoperative complications of intravitreal TAAC.[27] In our case series, even if significantly increased for use of tamponading agents, postoperative IOP never exceeded 25 mmHg. We have encountered low anterior chamber flare and cellular reactions in all eyes, and we have never observed a fibrin syndrome. No residual or recurrent ERMs were detected in any of our patients at the end of the follow-up period. This result might be due to the complete removal of the ERM and to the strong antiinflammatory and antiproliferative effects of TAAC. In the only eye that experienced a retinal redetachment, it was caused by an unrecognized peripheral open tear. The results of this case series are limited by the short follow-up, and they must be confirmed by randomized and prospective investigations. Nevertheless, it may be possible to infer that intravitreal injection of commercially available TAAC is not toxic to intraocular structures and enables the surgeon to perform a complete and fast removal of the posterior hyaloid, vitreous base gel, and ERMs, thus becoming an additional useful tool in the surgical treatment of PVR.

Key words: epiretinal membrane, intravitreal corticosteroid, proliferative vitreoretinopathy.

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