·Clinical Research·

The outcomes of pars plana vitrectomy without endotamponade for tractional retinal detachment secondary to proliferative diabetic retinopathy

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Abstract

• AIM: To evaluate the outcomes of pars plana vitrectomy (PPV) without the use of an ocular tamponade in patients having tractional retinal detachment (TRD) secondary to proliferative diabetic retinopathy (PDR).

• METHODS: It was an interventional study conducted at the Department of Ophthalmology, B.V. Hospital, Bahawalpur, Pakistan, from July 2011 to July 2012. A total of 75 patients (84 eyes) having TRD secondary to PDR were treated by PPV without using an ocular tamponade. All patients included in the study had a tractional retinal detachement secondary to proliferative diabetic retinopathy but didn´t have or develop retinal breaks before or during the study period. The surgical procedure included a PPV combined with the removal of the tractional retinal membranes and the application of endolaser photocoagulation to the retina. The mean follow-up period was 12 months.

• RESULTS: Successful retinal reattachement was observed in 78 of the operated eyes (92.8%). In these patients, the retina remained attached till the end of the one year follow -up period. Improvement in best corrected visual acuity (BCVA) was seen in 63 eyes (75%).The visual acuity remained unchanged in 9 eyes (10.7%). Mean improvement in BCVA was 2.00+1.24 at baseline to 1.24+1.22 (*P*<0.05) at the end of the follow-up period.

• CONCLUSION: In the absence of the retinal breaks, a TRD secondary to PDR can be successfully treated by pars plana vitrectomy without the use of an ocular tamponade.

• KEYWORDS: endotamponade; pars plana vitrectomy; proliferative diabetic retinopathy; tractional retinal detachment

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INTRODUCTION

Diabetic retinopathy is a vascular retinal disease. Prolonged hyperglycaemia in diabetes leads to an increased permeability and progressive occlusion of the retinal vessels. These alterations may lead to retinal lesions such as hard exudates, macular oedema, soft exudates and ischemia with visual impairment [1]. Ischemia results in production of angiogenic factors, development of neovascularisation and the formation of fibrovscular membranes. The fibrous element of a fibrovascular complex may contract, causing the vitreous to induce traction on the retina. This can potentially result in a tractional detachment of the retina.

Proliferative diabetic retinopathy with tractional retinal detachment is therefore one of the most feared ocular complications of diabetes mellitus[1-3]. The studies such as the Early Treatment of Diabetic Retinopathy Study (ETDRS) and The Diabetic Retinopathy Study (DRS) have convincingly shown the benefits of panretinal laser photocoagulation (PRP) to reduce the risk of development of proliferative diabetic retinopathy (PDR) and tractional retinal detachment (TRD)[4,5].

Once the proliferative diabetic retinopathy leads to a tractional detachment specially the one involving the macula, the indicated treatment is often a pars plana vitrectomy with adjunctive procedures [3-6]. A review of the literature does not clarify the issue of whether an ocular tamponade should be used or not during pars plana vitrectomy in an eye having a tractional retinal detachment but without having retinal breaks[3,6-14].

The idea that an endotamponade is not necessary in an eye with a tractional retinal detachment is not novel. Going back to the early days of vitrectomy surgery, there have been several studies reporting that ocular endotamponade was not necessary if retinal breaks were not present. In 1980, the landmark study by Meredith *et al* [4] described the membrane sectioning technique for diabetic vitrectomy, and the authors stated that there was no need to drain the subretinal fluid if no breaks are present, because relief of traction is sufficient to allow reattachment of the retina. In an investigation published by Aaberg [14] in 1981, intraocular gas tamponade was used in only 18 of 125 eyes with diabetic macular tractional retinal detachment. In 1983, Rice *et al* [15] used ocular gas endotamponade only in eyes with retinal breaks among 197 patients with diabetic tractional retinal detachment. In 1987, Thompson *et al* [16] applied intraocular gas in only 67 of 301 eyes with diabetic tractional retinal detachment. In 1989, Williams *et al* [17] in a group of eyes with diabetic tractional retinal detachment treated with the en-bloc technique without using gas in 49% of the eyes.

Although the studies cited above reported the use of ocular endotamponade, they did not focus on the question of whether or not an endotamponade is necessary if the retinal breaks are not present in an eye having a tractional detachment secondary to proliferative diabetic retinopathy. It is a well-known fact that the best intervention is the one having the smallest number of complications, and when compared with pars plana vitrectomy using a tamponade, vitrectomy without tamponade has less risk of postoperative complications (such as oil/gas-related intraocular pressure increase and/or cataract).

We conducted this study so as to assess the outcomes of pars plana vitrectomy without an ocular tamponade for treatment of tractional retinal detachment secondary to proliferative diabetic retinopathy. Despite its design as a case-series study, the study was performed to obtain information for addressing the hypothesis whether an ocular endotamponade should be performed or not if an eye with tractional detachment and proliferative diabetic retinopathy undergoes pars plana vitrectomy.

SUBJECTS AND METHODS

Subjects This interventional case-series study was conducted at the Ophthalmology Department of B. V. Hospital, Bahawalpur, Pakistan. The permission for the study was taken from the local ethical committee of this hospital in June 2011. A written informed consent was taken from all the patients before conducting the study. The study included eyes with diabetic tractional retinal detachment that were consecutively treated by pars plana vitrectomy without ocular endotamponade from July 2011 through July 2012. The patients included in the study were operated on by an experienced vitreo-retinal surgeon in the same institution.

The patients included in our study met the following inclusion criteria: 1) Patients having proliferative diabetic retinopathy with tractional retinal detachment; 2) No preexisting retinal breaks and no iatrogenic retinal breaks during surgery detected; 3) Intraocular tamponade (silicone oil/gas) was not used at the end of surgery; 4) The follow-up period was at least 1 year.

Methods The data were collected on standardized forms in a consecutive manner. Before surgery and at regular intervals after surgery, the patients underwent an ophthalmic examination, including best-corrected visual acuity (BCVA) measurement using a logarithmic visual acuity chart (log MAR chart), slit lamp biomicroscopy of the anterior segment of the globe, tonometry, and ophthalmoscopy.

For eyes with opacities of the optic media preventing ophthalmoscopic assessment of the ocular fundus, a b-scan ultrasound examination was preoperatively performed. However, the eventual diagnosis of a tractional retinal detachment was based on the intraoperative findings. For those patients with relatively clear optic media before surgery, the diagnosis of a tractional retinal detachment was made during the preoperative examination. The visual acuity measurements were converted into logarithm of the minimum angle of resolution values for statistical analysis, and the calculation results were converted back into decimal values for this report.

All eyes underwent standard 3-port pars plana vitrectomy using 20-gauge (20G) instrumentation with a bimanual technique and using Binocular Indirect Operating Microscope system (BIOM). Vitrectomy included removal of the posterior and peripheral vitreous body, induction of the posterior vitreous detachment and peeling of the fibrovascular epiretinal membranes from the retinal surface. Panretinal endolaser photcoagulation with up to 1 000 laser coagulation spots was applied to all eyes included in the study. The number of intraoperative endolaser spots depended on the preoperative laser status and the amount of attached retinal surface during surgery. During follow-up, with a gradual absorption of the subretinal fluid, the laser coagulation was supplemented in the retinal areas previously detached. An intraoperative retinotomy to drain the subretinal fluid was not performed, and the subretinal fluid remained untouched. According to the inclusion criteria, there were no preexisting or iatrogenic retinal defects during surgery. Ocular endotamponade using silicone oil or gases was not performed. Intravitreal anti-neovascular drugs or steroids were not applied. We used modified lactated Ringer solution as irrigating solution, which included 0.4% glucose, 16U/mL tobramycin, 0.0001% epinephrine, and 0.0016% dexamethasone.

Statistical Analysis Statistical analysis was performed using a commercially available computer software system (SPSS, version 10). The data were presented as mean standard deviation when appropriate. A Student's t-test or paired samples t-test was performed whenever preoperative data were compared with the postoperative measurements. A P-value of <0.05 was considered statistically significant.

RESULTS

The study included 75 patients (84 eyes). Among these, 40 patients were female and 35 were male, with a mean age of 52 years (range 40-60 years). Of the 75 patients, 11 patients (14.6%) had insulin-dependent diabetes mellitus with a mean duration of 14.0 years (Table 1), and the remaining 64 patients (85.3%) had non-insulin dependent diabetes mellitus, treated by oral medication with a mean duration of 11.0 years (range, 10-30 years). Of the 84 eyes, 5 eyes (5.9%) were pseudophakic, 33 (39.2%) had cataract, and 46 (54.7%) had a clear lens (Table 2).

Panretinal laser photocoagulation had been performed before surgery in 40 eyes (47.6%). In 25 eyes (29.7%), severe vitreous hemorrhage prevented preoperative examination of the fundus. In 11 eyes (13%), severe vitreous hemorrhage was combined with macular tractional retinal detachment as determined intraoperatively; 24 eyes (28.5%) showed tractional detachment of the macula with clear optic media (Table 3). Overall, the macula was detached in 35 eyes (42.8%). The preoperative tractional retinal detachment involved 1 retinal quadrant in 48 eyes (57.1%), 2 quadrants in 15 eyes (17.8%), 3 quadrants in 6 eyes (7.1%), and 4 quadrants in 15 eyes (17.8%). The pars plana vitrectomy was combined with cataract surgery and intraocular lens implantation in 33 eyes (39.2%).

The preoperative BCVA (logarithm of the minimum angle of resolution) was 2.00+1.24. The mean follow-up was 12 months.

The retina reattached in 78 eyes (92.8%) and remained attached until the end of the follow-up period in these eyes without any further surgical intervention. In 5 eyes (5.9%), the retina remained detached during the follow-up (Table 4). The visual acuity in these 5 eyes with remaining retinal detachment ranged from no light perception (NLP) in 1 eye to 0.30 in 1 eye. In 4 of these 5 eyes, retinal holes in the midperiphery or outer retinal periphery could be detected, which were treated by a second pars plana vitrectomy with intraocular tamponade with 16% C2F6, 25% SF6, or silicone oil.

At the end of follow-up, the mean BCVA (logarithm of the minimum angle of resolution) improved to 1.24+1.22 with a P-value <0.05 (statistically significant) (Table 5). It had improved in 63 eyes (75.0%), remained unchanged in 9 eyes (10.7%), and became worse in 12 eyes (14.2%) (Table 6). In two eyes of two patients who were not consenting for a second vitreoretinal intervention, because of remaining retinal detachment, postoperative visual acuity was no light perception (NLP). None of the eyes developed increased intraocular pressure.

Table 1 Demographic characteristics of patients

Age range (a)	Total patients	IDDM	NIDDM
Total	75 (100%)	11 (14.6%)	64 (85.3%)

IDDM: Insulin dependent diabetes mellitus; NIDDM: Non-insulin dependent diabetes mellitus.

Table 2 Slit-lamp findings

Phakic eyes having clear lens	Eyes having cataract	Pseudo-phakic eyes	Total eyes
46 (54.7%)	33 (39.2%)	5 (5.95%)	84 (100%)

Table 3 Ophthalmoscopy findings

Sever VH	Sever VH with TRD	Macular TRD
25 (29.7%)	11 (13.0%)	24 (28.5%)

VH: Vitreous hemorrhage; TRD: Tractional retinal detachment.

Table 4 Anatomical outcomes of PPV

Eyes having successful retinal re-attachment after primary PPV	Eyes having retinal re-detachment after primary PPV	Total eyes
78 (92.8%)[a]	5 (5.9%)	84 (100%)

[a]P<0.05 (statistically significant); PPV: Pars plana vitrectomy.

Table 5 Pre and Post-operative visual acuity status (logMAR)

Baseline (Mean+SD)	End of follow up period (Mean+SD)
2.22+1.22	1.24+1.00[a]

[a]P<0.05 (statistically significant); SD: Standard deviation.

Table 6 Visual outcome of PPV

Eyes having visual improvement	Eyes having no visual Improvement	Eyes with worsening of postoperative VA	Total eyes
63 (75.0%)[a]	9 (10.7%)	12 (14.2%)	84 (100%)

[a]P<0.05 (statistically significant); VA: Visual acuity.

DISCUSSION

To our knowledge, this is the first study conducted on this topic in Pakistan. In most of the eyes in our study, successful retinal reattachment was seen after pars plana vitrectomy without ocular tamponade, and the retina remained attached until the entire follow-up period. Consequently, the BCVA improved in 75% of the eyes and remained unchanged in 11%. From these findings, one may infer that if the retina is intact at the end of the peeling of epiretinal membranes, the operating surgeon may elect not to use an ocular endotamponade. This procedure avoids postoperative complications of intravitreal gases such as intraocular pressure rise and pressure related optic nerve damage, reduced vision due to the intraocular gas bubble, and difficulties in observing the fundus for the examination. It also avoids postoperative complications of intravitreal silicone oil such as silicone oil induced hyperopia and anisometropia, silicone oil emulsification, secondary open angle glaucoma, cataract development and silicone oil displacement into the anterior chamber[1,3,16].

In general, PPV is indicated in case of presence or a threat of macular detachment in advanced diabetic eye disease. In our study; 35 of 84 eyes had macular detachment. The surgical procedure we adopted in our study is partially in contrast to some previous studies, in which intraocular silicone oil or intraocular gases were almost routinely used after pars plana vitrectomy for severe tractional retinal detachment[4,17-19].

We also suggest that intraoperative transretinal drainage of the subretinal fluid may not be necessary to reattach the retina in all eyes with a diabetic tractional retinal detachment. If the major epiretinal tractional membranes were removed or relieved during surgery, the subretinal fiuid may absorb spontaneously, similar to the resorption of subretinal fiuid in eyes with a rhegmatogenous retinal detachment in which the retinal break was sealed by an episcleral buckle[20-23].

Another observation made in our study was that patients with large preoperative retinal tractional detachments involving all quadrants more often required second surgery either because of new retinal breaks or because of unresolved subretinal fiuid. Fifty percent of all patients requiring second surgery were from this group. It may suggest that this flgure supports the use of a short acting intraocular gas such as 20% SF6 during the primary surgery to reduce the need of having a second surgery for these patients.

However, in our study, intravitreal bevacizumab was not used as a preparatory preoperative step to reduce the risk of intraoperative bleeding and thus to improve the intraoperative conditions for the surgeon. One may speculate that preoperative bevacizumab or preoperative use of any other antivascular endothelial growth factor drug may have improved the rate of postoperative retinal detachment in the group of patients with a preoperative four quadrant tractional retinal detachment.

Potential limitations inherent in our study should also be mentioned. The most important limiting factor was the design of the study as it was a case series having no control group. A higher level of scientific evidence could have been achieved, if a (randomized) comparative study had been performed with two groups of patients, the one group receiving an intraocular tamponade and the other group of patients without intraoperative tamponade. However, to plan and design such a study, it is necessary to have data on patients not receiving an intraocular tamponade to justify performing such an investigation. In view of the relatively small number of patients included in our study and in view of the homogenous structure of the surgeon group, the findings of our study may, therefore, form a basis to perform such a randomized trial.

Another limitation of our study is that optical coherence tomography was not performed to examine whether the subretinal fluid was absorbed or not after the initial surgical procedure. The absorption of the subretinal fluid was assessed on the ophthalmoscopic and sonographic examination. One cannot exclude the possibility that in some patients, residual shallow submacular fluid remained undetected causing a delay in visual recovery.

In conclusion, through our study we conclude that in the absence of the retinal breaks, a TRD secondary to PDR can be successfully treated by pars plana vitrectomy without the use of an ocular tamponade.

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