

SURGICAL TREATMENT OF RHEGMATOGENOUS RETINAL DETACHMENT IN THE ONLY SEEING EYE

Chrapek Oldřich^{1,2}, Matušková Veronika^{1,2}, Vysloužilová Daniela^{1,2}, Souček Jan^{1,2}, Sičová Kristína², Březík Michal²

¹Eye Clinic, University Hospital, Brno, Czech Republic

²Department of Ophthalmology, Faculty of Medicine, Masaryk University, Brno, Czech Republic

The authors of the study declare that no conflict of interests exists in the compilation, theme and subsequent publication of this professional communication, and that it is not supported by any pharmaceuticals company. The study has not been published to date in any journal, and has not been sent for publication in any journal.

Presented at the 31st Annual Congress of the Czech Society of Ophthalmology in Hradec Králové in 2023

Submitted to the editorial board: June 24, 2024

Accepted for publication: July 18, 2024

Available on-line: August 25, 2024



Doc. MUDr. Oldřich Chrapek, Ph.D.
Slunečná 820/1D
779 00 Olomouc
E-mail: chrapek.oldrich@fnbrno.cz

SUMMARY

Aim: To retrospectively evaluate the anatomical and functional success of surgical treatment of rhegmatogenous retinal detachment (RRD) in the only remaining seeing eye.

Material and methods: The study included 28 eyes of 28 patients, 19 (68%) of whom were men, with an average age of 46 years. They were operated on by a single surgeon for RRD at the Eye Clinic of the University Hospital and Faculty of Medicine, Masaryk University in Brno, from July 1, 2019, to April 30, 2023, using cryosurgical techniques and/or 25G+ pars plana vitrectomy (PPV). In 11 patients, 25G+ PPV was performed with the application of a pre-equatorial cerclage. The Blunt ocular trauma and uncomplicated cataract surgery with implantation of a posterior chamber intraocular lens were admissible within the patient histories. The cause of RRD was retinal tear(s) regardless of their number and location. The transparency of the anterior segment of the eye enabled reliable visualization of the posterior segment. Preoperative proliferative vitreoretinopathy (PVR) grades A-D2 were acceptable. Patients with a history of penetrating eye injury were excluded. Patients were evaluated 1-3 months after the performance of PPV. The surgery was considered anatomically successful if the retina was completely reattached. Each patient's final visual acuity (VA) was assessed using a Snellen chart. Numerical results were expressed as arithmetic means and percentages. Since the different groups were not compared, no statistical tests were needed.

Results: Retinal reattachment was achieved in 27 patients (97%), while 1 patient (3%) experienced retinal detachment, resulting in anatomical failure of the treatment. 9 patients (32%) achieved VA \geq 4/8.

Conclusion: We consider cryosurgical techniques using episclerally fixed cerclage bands and buckles, 25G+ PPV, and possibly a combination thereof, to be suitable methods for treating RRD in the only remaining seeing eye.

Key words: rhegmatogenous retinal detachment, visual acuity

Čes. a slov. Oftal., 80, 2024, No. x, p.

INTRODUCTION

Rhegmatogenous retinal detachment (RRD) is the separation of the neurosensory retina from the retinal pigment epithelium with the presence of a tear or hole in the light-sensitive retinal layer, in which fluid penetrates through this tear or hole into the subretinal space, resulting in a mutual separation of both layers of the retina. Hidden beneath this relatively simple and brief definition of retinal pathology are countless variable findings and conditions. RRD can be treated using 3 basic types of procedures. In the 1950s Schepens referred to the use of cryosurgical techniques with the

use of episclerally fixed cerclage bands and buckles [1,2]. At the turn of the 1970s Machemer introduced pars plana vitrectomy (PPV) [3]. In 1986 Hilton and Grizzard referred to pneumatic retinopexy as a third option for treating RRD [4].

The objective of this study is to retrospectively evaluate the anatomical success rate and functional results of surgical treatment of RRD in patients in whom RRD had developed in the only remaining seeing eye, and who were operated on at the Eye Clinic of the University Hospital and Faculty of Medicine, Masaryk University in Brno, from July 1, 2019, to April 30, 2023. The first objective is to assess the success rate of the

performed direct operations, the second objective is to evaluate the success rate of definitive retinal reattachment. The third objective is to evaluate the patients' resulting postoperative visual acuity (VA).

MATERIAL AND METHOD

The evaluated cohort comprised patients with RRD whose other eye was completely blind, or was within the zone of deep practical blindness. VA in the unoperated eye of each patient is expressed in Graph 1. Blunt ocular trauma and uncomplicated cataract surgery with implantation of a posterior chamber intraocular lens were admissible within the patient histories. The cause of RRD was retinal tear(s) regardless of their number and location. The transparency of the cornea and anterior segment of the eye enabled reliable visualization of the posterior segment. Patients preoperatively diagnosed with proliferative vitreoretinopathy (PVR) grades A-D2 were also included in the evaluated cohort. Patients with a history of penetrating eye injury were excluded.

The surgical treatment of RRD in the patients in the cohort consisted in the use of a cryosurgical technique or 25G+ PPV. Pneumatic retinopexy was not performed on any of the patients.

The essence of the cryosurgical treatment was perilimbal peritomy, localization of the retinal tear(s), exocryocoagulation of the edges of the retinal tear(s) and episcleral filling.

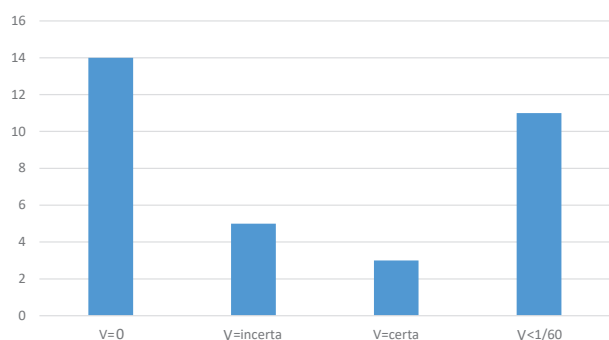
The essence of three-port 25G+ PPV was removal of the vitreous, identification of retinal tears, according to requirement peeling of the epi/subretinal membranes, temporaryperioperativestabilizationofretinaldetachment with air or liquid perfluorocarbon, treatment of retinal tears with endolaser photocoagulation or exocryocoagulation and internal tamponade with expansive gas or silicone oil (SO). Non-expansive concentrations of sulfur hexafluoride gas (20% SF₆) or perfluoropropane (16% C₃F₈) were used. The most frequently used was SO 1300 cts. In the case of complicated findings, pre-equatorial cerclage was also applied during the course of 25G+ PPV, with suturing of

a cerclage band with a width of 2 mm into the pre-equatorial position with the anterior edge of the cerclage band 11 mm from the corneal limbus.

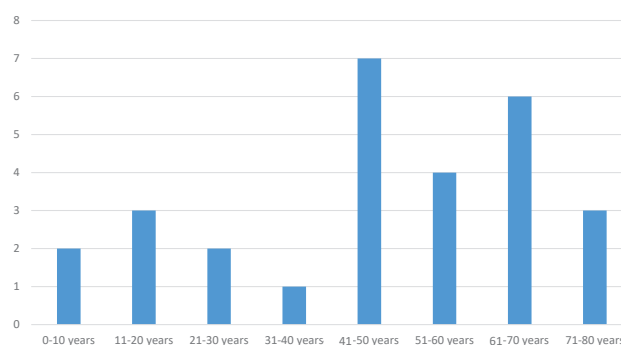
The patients were evaluated 1 to 3 months after surgery. An examination of the ocular fundus was conducted by biomicroscopy and indirect ophthalmoscopy. The surgery was considered anatomically successful if the retina was completely reattached, thus if contact of the neuroepithelium and the pigment epithelium was restored on the posterior pole and throughout the entire periphery. The surgery was considered anatomically unsuccessful if the retina was judged to be detached, thus if persistent separation of the neuroepithelium and pigment epithelium was found at least in part on the posterior pole or on the retinal periphery. Each patient's final (postoperative) (VA) was assessed, examined as natural VA or VA with the patient's own glasses correction. If natural VA or VA with the patient's own correction did not appear to be satisfactory in the postoperative period, for example following the implantation of SO, revised glasses correction chosen according to measurement on an autorefractometer was used for determination of final VA. Examination of VA was performed using a Snellen chart. We evaluated the best VA attained within the period of 1–3 months after surgery as the patient's final VA.

The attained numerical results were expressed as arithmetic means and the numerical values were also expressed in percentages. Since the different groups were not compared, no statistical tests were needed.

The cohort comprised 28 eyes of 28 patients, 19 (68%) of whom were men and 9 (32%) of whom were women. The average age of the patients in the cohort was 48 years (youngest 3 years, oldest 79 years), and the age distribution of the patients in the cohort is illustrated in Graph 2. All the patients were operated on by a single surgeon at the Eye Clinic of the University Hospital and Faculty of Medicine, Masaryk University in Brno, from July 1, 2019, to April 30, 2023. The right eye was affected in 15 cases (53%), the left eye in 13 cases (47%). In 24 eyes of 24 patients this concerned newly diagnosed, thus far untreated cases of RRD. In 4 eyes of 4 patients, the operating surgeon



Graph 1. Levels of visual acuity in unoperated eyes
V – visual acuity



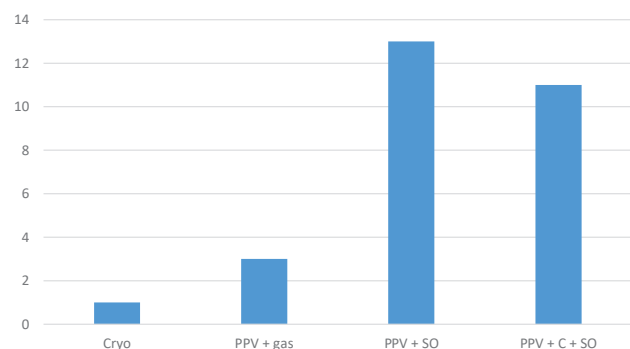
Graph 2. Age of the patient cohort

took over the care of a patient who had originally been unsuccessfully operated on by another surgeon for newly diagnosed RRD. All the patients were operated on under general anesthesia.

A cryosurgical procedure was performed on 1 patient with suturing of an episcleral buckle, in 27 patients 25G+ PPV was performed, in 11 patients it was performed with suturing of an episcleral band. The frequency and type of procedure performed on the patients is expressed in Graph 3.

RESULTS

For 27 (97%) patients a single operation was sufficient in order to achieve reattachment of the retina, for 1 (3%) patient the retina was not reattached after the performance of 25G+ PPV, thus the primary operation



Graph 3. Performed surgical procedures

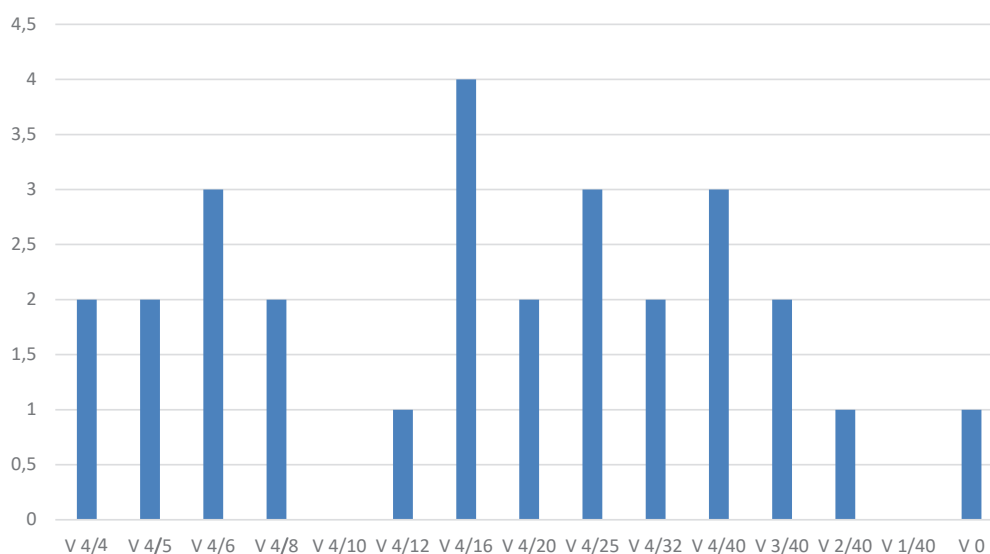
Cryo – cryosurgery, PPV + gas – pars plana vitrectomy with internal gas tamponade, PPV + SO – pars plana vitrectomy with internal silicone oil tamponade, PPV + C + SO – pars plana vitrectomy with cerclage and internal silicone oil tamponade

was unsuccessful. The single primarily unsuccessfully operated patient was reoperated on. The technique of 25G+ PPV with internal SO tamponade was used for reoperation, but reattachment of the retina was again unsuccessful, and any further surgical procedures were abandoned due to rapidly progressing PVR. Overall we can state that out of 28 patients in the cohort, in 27 (97%) we achieved definitive retinal reattachment within the full scope, and therefore definitive anatomical success, while in 1 (3%) patient the retina remained detached and we concluded anatomical failure of the treatment.

Of the 27 successfully operated patients, in 1 patient an external operation with cryoretinopexy of a retinal tear and episcleral fixation of a radial buckle was performed. In 3 patients 25G+ PPV with internal gas tamponade was performed, in 13 patients 25G+ PPV with SO tamponade and in 11 patients 25G+ PPV with SO and suturing of a pre-equatorial cerclage.

It is possible to state that out of the 27 patients in whom RRD was treated using 25G+ PPV, in 24 (89%) patients primary PPV or re-PPV was completed with SO tamponade. In 3 (11%) patients 25G+ PPV was completed with gas tamponade. By the end of the monitored and evaluated period (April 30, 2023), SO had been successfully evacuated in 3 patients – after evacuation of SO the retina remained attached within its full scope. In 21 patients SO was still present in the vitreous cavity at the end of the observation period, while anatomical success was achieved in all of these 21 patients under SO tamponade.

The resulting level of VA in the postoperative period is expressed in Graph 4. VA of $\geq 4/8$ was attained in 9 (32%) patients, and VA of $\geq 4/40$ in 24 (86%) patients. In the one patient in whom we did not achieve anatomical success, VA was 0.



Graph 4. Achieved levels of visual acuity in the postoperative period

DISCUSSION

Three therapeutic approaches are currently considered in the treatment of RRD: pneumatic retinopexy, cryosurgical techniques and PPV. However, pneumatic retinopexy is indicated only in the case that retinal detachment is caused by a tear localized in the superior perimeter periphery between numbers 8–4 on the clock face and the scope of this tear is maximally within the range of one hour [4]. Tornambe states that primary anatomical success is attained in only 75% of phakic and 67% of arterphakic eyes [5]. For the above reasons the use of pneumatic retinopexy is limited in the treatment of RRD, and the doctor usually decides between cryosurgical techniques and PPV. No clear boundary exists between the use of a cryosurgical procedure and PPV. The reason for this is high variability of the clinical finding associated with a diagnosis of RRD, in which uncomplicated localized retinal detachment with a single tear may be present on one hand, while on the other hand there may be total retinal detachment with multiple tears and preoperative PVR. With regard to the complexity of the preoperative clinical finding, it is possible to agree with the division of patients into three basic groups as was performed by Feltgen in his study [6]. Feltgen observed 50% of patients with localized retinal detachment (within a scope of 4 perimeter hours) with a single tear or adjacent tears. Most of these patients were treated cryosurgically [6]. At the opposite end of the spectrum of clinical findings were 20% of patients with complicated findings, with PVR grades B and C, large tears, macular holes, in which an indication for PPV predominated [6]. Between these two opposite poles of the cohort he observed 30% of patients with a medium-severe finding. He included in this group patients with multiple tears in different quadrants, bullous retinal detachment, tears spreading centrally beyond the equator, tears with perceptible vitreoretinal traction and patients with RRD and an unclear situation regarding tears (preoperatively without a finding of tears or with impossibility of identifying all tears preoperatively). In these patients PPV, cryosurgery or a combination of both was used [6].

Our patient treated with a cryosurgical technique would correspond in terms of the preoperative finding to the group which Feltgen designated as favorable. Studies can be found in the literature for such patients which contain cryosurgical procedures, even if in recent years the tendency has rather been to treat this group of patients also with PPV [7]. Soni conducted a meta-analysis of prospective, randomized, controlled trials, in order to evaluate the benefit of PPV versus cryosurgery for the treatment of uncomplicated rhegmatogenous retinal detachments with PVR grade B and less. He included 1306 eyes in the meta-analysis, of which 636 underwent PPV and 670 were treated cryosurgically. 523 eyes were phakic and 783 eyes were arterphakic / aphakic. Primary retinal reattachment was achieved in 177 out of 260 eyes (68%) operated on using PPV, and 179 out of 263 eyes (68%) of phakic patients operated on cryosurgically. Secondary retinal reattachment was attained in 253 out of 260 eyes

(97%) operated on using PPV and in 256 out of 263 eyes (97%) of phakic patients operated on cryosurgically. In the group of phakic patients Soni did not demonstrate any statistically significant difference between the group treated with PPV and the group treated cryosurgically either in the sense of primary or secondary retinal reattachment [8].

The patients in our cohort operated on using 25G+ PPV would correspond to all three groups defined by Feltgen above. Out of 27 patients operated on using 25G+ PPV, we used pre-equatorial cerclage on 11 patients. The indication for pre-equatorial cerclage was RRD of the inferior quadrants with tears or holes in the lower periphery between numbers 4–8, or a preoperative finding of PVR C1 or worse. Studies can be found in the literature which note the potential benefit of a combination of PPV with buckling techniques in order to improve the anatomical result of the operation. In a multicentric retrospective study, Joseph evaluated the anatomical results of PPV and PPV combined with buckling techniques in a cohort of 893 pseudophakic eyes with rhegmatogenous retinal detachment [9]. In 684 eyes (77%) PPV alone was performed, in 209 eyes (23%) PPV in combination with buckling techniques. Success of the primary operation is stated in a total of 770 eyes (86%), of which 577 (84%) in the group operated using PPV alone and 192 (92%) in the group operated on using the technique of PPV in combination with buckling procedures. In our cohort we achieved complete retinal reattachment in the primary operation in all 11 (100%) patients operated on using the technique of 25G+ PPV in combination with pre-equatorial cerclage. However, we are aware that this result may be distorted by the small size of the cohort.

In our cohort mean final VA of the patients was 4/11, which corresponds to a value of 20/55. In our cohort we did not evaluate the final VA of patients in whom the macula was attached preoperatively separately from the final VA of patients in whom the macula had been detached preoperatively. Precisely for this reason we are of the opinion that the final value of VA in the patients in our cohort is between the values of final VA mentioned by Joseph for his two subgroups. In Joseph's cohort the mean final VA in the patients who had an attached macula preoperatively was 20/32, while in patients who had a detached macula preoperatively mean final VA was 20/64 [9].

In 24 (85%) patients 25G+ PPV was completed with internal SO tamponade. In the past we referred to the fact that in patients with RRD treated with 25G+ PPV we complete the surgical procedure in 72% cases by internal gas tamponade [10]. The reason for the predominant indication of SO as the content of internal tamponade for patients with RRD in the only remaining seeing eye for us is above all the more rapid visual rehabilitation in comparison with gas tamponade. This is also compounded by the fact that in the first postoperative days the retina is already reliably clear under silicone oil, and that any potential development of re-detachment of the retina would be very

quickly identified and if applicable surgically treated. The last reason is the fact that if a patient has only one seeing eye, the problem of harmonizing postoperative refraction of the operated and unoperated eye ceases to exist. SO causes hypermetropization of the eye, but with regard to the fact that the operated eye is the only seeing eye, nothing prevents the configuration of optimal full glasses correction, most commonly 4–6 weeks after surgery.

At the end of the observation period SO had been discharged only in 3 patients, while in 21 patients SO was still present in the vitreous cavity. Although after PPV we usually discharge the silicone oil 4–6 months after its implantation, this may be different in the case of patients with only one seeing eye. A role is often played by the wishes of the patient, who if satisfied with the resulting best corrected visual acuity does not wish to undergo another surgical procedure with evacuation of SO, which involves the risk of repeated retinal detachment and loss of sight. We always proceed to evacuation of SO in the sole remaining seeing eye operated on for RRD only after a mutual agreement between the surgeon and the patient. As a result, it often occurs that the interval between implantation of the SO and its discharge is extended.

CONCLUSION

In 7 (25%) patients in our cohort we can conclude anatomical success, in which no internal tamponade is present in the operated eye. In anatomical terms these patients can be considered entirely cured. In 21 (75%) patients we can state anatomical success of the treatment, though at the cost that SO is still present in the vitreous cavity. In the case of these patients we cannot conclude definitive success in the treatment of RRD. Assessing the degree of anatomical success or failure in this subgroup of patients requires further observation, with evaluation of the applicable number of findings of reattached retina following the definitive discharge of SO in future. In 1 (3%) patient the retina remained detached even despite repeated 25G + PPV. This fact also has consequences for the functional result, in which VA is 0. On the other hand, it is necessary to emphasize that 32% of patients attained a result of functional VA of 4/8 or better. Overall, we therefore consider cryosurgical techniques using episclerally fixed cerclage bands and buckles, 25G+ PPV, and possibly a combination thereof, to be suitable methods for treating RRD in the only remaining seeing eye.

REFERENCES

1. Schepens CL. Progress in detachment surgery. *Trans Am Acad Ophthalmol Otolaryngol.* 1951;55:607-615.
2. Schepens CL, Okanuta ID, Brockhurst RJ. The scleral buckling procedures. I. Surgical techniques and management. *AMA Arch Ophthalmol.* 1957;58:797-811.
3. Machemer R, Parel JM, Buettner H. A new concept for vitreous surgery. I. Instrumentation. *Am J Ophthalmol* 1972;73:1-7.
4. Hilton GF, Grizzard WS. Pneumatic retinopexy. A two-step outpatient operation without conjunctival incision. *Ophthalmology.* 1986;93:626-641.
5. Tornambe PE, Hilton GF. The Retinal Detachment Study Group. A multicenter randomized controlled clinical trial comparing pneumatic retinopexy with scleral buckling. *Ophthalmology.* 1989;96:772-784.
6. Feltgen N, Weiss C, Wolf S et al. Scleral buckling versus primary vitrectomy in rhegmatogenous retinal detachment study (SPR Study): recruitment list evaluation. Study report no. 2. *Graefes Arch Clin Exp Ophthalmol.* 2007;245:803-809.
7. SPR Study Group. View 2: the case for primary vitrectomy. *Br J Ophthalmol.* 2003;87:784-787.
8. Soni Ch, Hainsworth DP, Almony A. Surgical management of rhegmatogenous retinal detachment: A meta-analysis of randomized controlled trials. *Ophthalmology.* 2013;120:1440-1447.
9. Joseph DP, Ryan EH, Ryan CM et al. Primary Retinal Detachment Outcomes Study: Pseudophakic Retinal Detachment Outcomes. *Ophthalmology* 2020;127:1507-1514.
10. Chrapek O, Matušková V, Vysloužilová D et al. Pars Plana Vitrectomy in the Treatment of Rhegmatogenous Retinal Detachment. *Cesk Slov Oftalmol.* 2024;80(1):12-15.