A Simple and Efficient Option for Rhegmatogenous Retinal Detachment: Pneumatic Retinopexy

Yırtıklı Retina Dekolmanı Tedavisinde Basit Ama Etkin Bir Seçenek: Pnömatik Retinopeksi

Selçuk SIZMAZ[1], Ebru ESEN[1], Püren IŞIK[2], Nihal DEMİRCAN[3]

ABSTRACT

Objective: To analyze the outcome of pneumatic retinopexy (PR) for repair of rhegmatogenous retinal detachment (RRD).

Materials and Methods: Medical chart of patients who underwent PR for RRD were retrospectively reviewed. Visual acuity, lens status, localization of the detachment, number of breaks, the duration of follow-up, and the demographic data were assessed. C_3F_8 gas was injected in all cases. In case of PR failure, the patients underwent pars plana vitrectomy. Patients with a follow-up less than 2 months were excluded.

Results: Twenty-one eyes of 21 patients (14 males, 7 females) with a median age of 59 (18-68) were included. Eight cases were pseudophakic and 13 were phakic. Preoperative visual acuity ranged from hand motions to 1.0. The median detached retina area in clock hours was 4 (2-7). In 19 cases, only 1 break was detected preoperatively. Peripheral retinal laser photocoagulation (360 degrees) was applied in 18 cases. 360-degree laser photocoagulation was significantly associated with successful outcome. Reattachment was achieved in 13 (61.9%) cases. No PR-related complications were encountered.

Conclusion: Pneumatic retinopexy is a safe and efficient procedure in selected cases.

Key Words: Pneumatic retinopexy, rhegmatogenous retinal detachment.

ÖZ

Amaç: Yırtıklı retina dekolmanında (YRD) pnömatik ertinopeksinin (PR) tedavisinin sonuçlarını değerlendirmek.

Yöntem: Yırtıklı retina dekolmanı için PR yapılan hastaların tıbbi kayıtları retrospektif olarak tarandı. Görme keskinliği, lensin durumu, dekolmanın yerleşimi, yırtık sayısı, takip süresi ve demografik veriler değerlendirildi. Tüm olgularda C3F8 gazı kullanıldı. Pnömatik retinopeksinin başarılı olmadığı durumda hastalara pars plana vitrektomi uygulandı. İki Aydan kısa takip süresi olan olgular çalışmaya alınmadı.

Bulgular: Ortalama yaşları 59 (18-68) olan 21 hastanın (14 erkek, 7 kadın) 21 gözü çalışmaya dahil edildi. Sekiz olgu psödofak, 13 olgu fakikti. Ameliyat öncesi görme keskinlikleri el hareketleri sayma ile 1,0 arasında değişiyordu. Dekole retina alan genişliği medyan 4 (2-7) saat kadranıydı. On dokuz olguda ameliyat öncesinde tek delik tespit edildi. Perifer retina lazer fotokoafulasyonu (360 derece) 18 olguya uygulandı. 360 derece perifer retina lazer fotokoagulasyonu başarılı sonuç ile anlamlı derecede ilişkiliydi. On üç (%61,9) olguda retina yatıştı. Pnömatik retinopeksiye bağlı bir komplikasyon meydana gelmedi.

Sonuç: Pmönatik retinopeksi seçilmiş olgularda güvenli ve etkin bir tedavi yöntemidir.

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1- Doç. Dr., Çukurova Üniversitesi, Göz Hastalıkları AD, Adana, Türkiye
2- Asist. Dr., Çukurova Üniversitesi, Göz Hastalıkları AD, Adana, Türkiye
3- Prof. Dr., Çukurova Üniversitesi, Göz Hastalıkları AD, Adana, Türkiye

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Yazışma Adresi / Correspondence Adress:
Selçuk SIZMAZ
Çukurova Üniversitesi, Göz Hastalıkları AD, Adana, Türkiye

Phone: +90 533 338 7700
E-mail: selcuk.sizmaz@gmail.com

INTRODUCTION

Pneumatic retinopexy (PR) has been used for the management of rhegmatogenous retinal detachment (RRD) for over 30 years.[1,2] It has several advantages; it is quick and easy, which can be performed under topical anesthesia even in office settings and it causes less tissue trauma compared with scleral buckling (SB) and pars plana vitrectomy (PPV); in addition, it is inexpensive. Pneumatic retinopexy has been shown to be effective in RRD cases located in the upper 8 clock hours of the retina (upper 2/3), with either a single break of 1 clock hour size or even multiple breaks no further apart or larger than 1 clock hour. Also, the media should be clear enough to enable indirect laser retinopexy and visualization of all breaks. [1,3,4] Grade C and D proliferative vitreoretinopathy (PVR) was found to be strongly associated with failure of the procedure.

The procedure was reported to have minor adverse effects and it is devoid of the major side effects associated with SB (e.g., extra-ocular muscle imbalance, diplopia, intractable discomfort) or PPV (e.g., cataract).[5] Another advantage of PR is that, in case of failure, the patient has still chance of SB or PPV. Moreover, the final visual acuity (VA) is proposed to be unaffected by the failure of PR.[3,6]

The purpose of this study is to report the anatomic and functional outcomes of PR in RRD.

MATERIALS AND METHODS

In this retrospective study, the medical charts of patients underwent PR from December 2013 to May 2017 were reviewed. The study is conducted according to Declaration of Helsinki.

Demographics of patients, initial VA, lens status, the localization and width of the tear as well as that of the detached retina (in clock hours), number of tears, presence and grade of PVR, if any, and the duration of follow-up were assessed.

Participants

Pneumatic retinopexy was administered in eyes with a primary detached retina involving the upper 2/3 (from 8 to 4 clock quadrants), with a single break with a maximal width of 1 clock hour or multiple breaks in close location. Eyes with media opacities, aphakic or pseudophakic eyes with an anterior chamber intraocular lens (IOL), eyes with PVR grade C or worse, eyes with intraocular pressure (IOP) greater than 22 mmHg were excluded. Pneumotic retinopexy was avoided in patients younger than 18 years or who would likely fail head positioning. Possible flight in the following 6 weeks was also considered a reason for avoiding PR. Patients with a follow-up less than 2 months were excluded in the analysis.

Injection Procedure

All procedures were carried out at the operation room, under topical anesthesia and sterile conditions. Following draping the eyelids, topical povidone iodine 5% was applied onto the ocular surface and the lids were retracted with a speculum. A paracentesis was made at the horizontal quadrant. Then, 0.3 ml pure C_3F_8 gas, which was drawn into a tuberculin syringe via a Millipore filter, was injected into the vitreous cavity with a 30-gauge needle. The injection site was 3.5 mm behind the limbus at the quadrant opposite to the retinal break. The needle targeted the center of the globe to avoid lens damage. The gas was injected into the vitreous cavity with a slow and a continuous move while the injection site was positioned so as to stay at top; this helped to form a single gas bubble at the tip of the needle, as described by Hilton and Grizzard.[7] Also, care was taken to ensure the tip of the needle stayed inside the gas bubble during injection; this helped to maintain a single gas bubble. As the needle was withdrawn, pressure was applied over the injection site with a cotton-tip applicator. Then, the globe was positioned in the opposite direction to keep the gas bubble away from the entry site.

Immediately following injection, the central retinal artery pulsation was checked with indirect ophthalmoscopy. In case of a very high IOP or lack of pulsation, the IOP was lowered through the paracentesis by external pressure applied on the scleral edge of the paracentesis entry by the tip of the needle.

The patient was told to keep the head upright and tilted in one direction to enable the gas balloon to compress the retinal break.

The patient was prescribed topical antibiotics for 10 days and steroids, which were tapered at the end of the first month.

Laser Photocoagulation

Indirect laser photocoagulation was applied around the tear in the following 72 hours if the surrounding retina was attached. When there was no laser uptake due to persistent subretinal fluid in the following 5 days, the cases were considered to fail as the gas bubble was expected to shrink after 5 days.[8] In cases in which 360-degree laser retinopexy was applied, the laser was applied to flat retina prior to PR. In 360-degree laser retinopexy, laser beam was applied to the retina between the ora serrata and the equator. After the operation, laser was applied around the tear as described above and also the prior laser was completed to 360 degrees. The patient was instructed to maintain the head position for several days following laser retinopexy to ensure chorio-retinal adhesions at the sites of photocoagulation was achieved.

The patient was examined at the first day, first week, first and second month of the procedure. The follow-up was then maintained according to the clinical status. Attached retina at the end of 2 months without any additional surgical procedure was accepted as primary success. If the retina

did not flatten till the fifth day of the operation to enable laser retinopexy, those cases were considered to fail. In case of failure, PPV was the treatment of choice. Cases that did not achieve reattachment or re-detachment as the gas bubble shrunk were accepted failure. No cryotherapy was applied.

Statistical Analysis

Descriptive analysis was made to assess the demographic features, clinical data at presentation, and anatomical and functional outcome. Statistical analyses were performed using the statistical package *SPSS software* (version 23.0, SPSS Inc., Chicago, IL, USA). Categorical measures were given in number and percentage while continuous measures were described as the median (interquartile range). Comparisons between groups were made by Mann Whitney U test in skewed data .Categorical variables between groups were analyzed by Chi square or Fisher's exact tests. A p value of <0.05 was considered statistically significant.

RESULTS

Twenty-four eyes of 24 patients were reviewed. Three cases were excluded due to lost during follow-up; thus, 21 eyes of 21 patients were included. The median age of patients was 59, ranging between 18 and 68. The group included 14 (66.7%) men and 7 (33.3%) women. Thirteen (61.9%) eyes were phakic while 8 (38.1%) eyes were pseudophakic. The median width of detached retinal area in clock hours was 4 (2-7). The detachment was associated with a single break in 20 (95.2%) eyes, whereas 2 breaks were detected in one (4.8%) patient. The macula was unaffected in 16 (76.2%) eyes whereas 5 (23.8%) eyes had macula off RD. 360-degree laser retinopexy was applied in 18 (85.7%) patients.

Pneumatic retinopexy failed in 8 cases (38.1%). Failed cases underwent PPV and additional breaks were detected in 4 of these cases. At the end of a median 10 months of follow-up (4-38), 13 (61.9%) eyes remained attached and PR was considered successful. Interestingly, 1 successful case detached 9 months following PR. A fresh break next to the prior laser spots was detected to cause the detachment; this patient underwent PPV and silicone oil tamponade.

No adverse event attributable to PR was observed such as increased IOP or endophthalmitis. No case of subsequent PVR or epiretinal membrane (ERM) were encountered in the successful cases.

Tables 1 and 2 give the comparison of successful and failed cases by means of the factors proposed to affect the outcome. Age, gender, visual acuity, lens status, macular involvement, the extent of detachment, number of tears was found to have mo significant effect on the outcome. On the contrary, 360-degree laser retinopexy was significantly associated with favorable anatomical success.

Table 1. *Comparison of successful and failed cases by means of continuous measures.*

	Failed	Successful	
	Median (Interquartile Range)	Median (Interquartile Range)	p
Age	59 (10)	56 (16)	0.374
Detachment*	4 (1)	3 (2)	0.275
Visual acuity†	0.2 (0.18)	0.3 (0.3)	0.121
Follow-up	-	10 (7)	-

* The extent of the detachment in clock hours
† Best corrected visual acuity at presentation in logMAR

Table 2. *Comparison of successful and failed cases by means of categorical variables.*

	Failed		**Successful**		
	n	%	n	%	p
Gender					
Males	7	87.5	7	53.8	0.174
Females	1	12.5	6	46.2	
Lens					
Phakic	5	62.5	8	61.5	1.000
Pseudophakic	3	37.5	5	38.5	
Macula					
Off	3	37.5	2	15.4	0.325
On	5	62.5	11	84.6	
Breaks #					
1	7	87.5	13	100.0	0.381
2	1	12.5	0	0.0	
360 Laser					
No	3	37.5	0	0.0	**0.042**
Yes	5	62.5	13	100.0	

DISCUSSION

Despite the advances in vitrectomy techniques such a smaller incisions and enhanced cut rates, PR still remains a good option in selected RRD cases with minor complications compared to SB and PPV. The success rate of PR was reported to range from 44% to 94%, with an average of 74.4%.[9] Thus, our success rate (61.9%) was in accordance with the literature. In a review of 422 cases, the success rate of PR alone was found to be 60.7%.[10] Cohen and co-workers, reported the success rate of primary PR as 59.5%.[11]

Although the success rate of PR is somewhat lower than PPV (71-96.7%) and SB (68.2–93.7%), the procedure has significant advantages. Pneumatic retinopexy is a quick and inexpensive procedure, which can even be performed in

office settings. Another advantage is the relatively small number of associated complications. It is far from bearing PPV and SB associated complications, which are iatrogenic retinal breaks, PVR, cataract formation and pain, explant extrusion, ocular motility problems, respectively.[3] The most serious complications following PR are infectious endophthalmitis and giant retinal tear; gas leakage into the anterior chamber was also reported.[3,12,13] We encountered no complications or adverse effects which could be attributable to PR.

Rootman and co-workers reported that large tears, pseudophakia, and PVR were the three main factors associated with failure in PR.[8] Hence, the number and localization of breaks should be properly addressed prior to operation. The lens status makes sense. It could be hard to evaluate the periphery of the retina in phakic cases with significant cataract or in pseudophakic cases, particularly those with some degree of capsular phimosis or posterior capsular opacification. These situations could lead to overlook of small breaks. Cataract or capsular opacities could also be troublesome in laser retinopexy. There are reports suggesting that the lens status was not a significant factor for success in PR.[1,3] In our study, we did not encounter a significance between success and lens status. However, we believe that the small sample size might have an effect on this finding.

Laser retinopexy has substantial importance in PR. Because, the traction causing the tear is not eliminated in PR; the gas bubble forces the detached sensorial retina against the retinal pigment epithelium, where it was expected to adhere. Laser helps to seal the break while the retina is attached; thus, when the gas shrinks, the laser barrier avoids the break to re-open. Another advantage occurs with 360-degree laser retinopexy between the equator and the ora serrata, as the procedure helps to avoid failure due to new or missed retinal breaks.

The association of PVR with failure in PR is a somewhat expected condition. In PVR, PR fails to overcome tractional forces on the retina; moreover, retinal shortening exerts a resistance against reattachment. Therefore, we avoided PR in cases with grade C or worse PVR.

One of the major concerns on PR is the risk of new breaks, which is promoted by lacunae in the liquefied vitreous . The movement of the expanding gas in the vitreous cavity might exert shearing forces and promote additional vitreoretinal traction, causing new breaks. Also, a preoperatively overlooked break could jeopardize the outcome. There comes the main advantage and rationale of 360-degree laser retinopexy, which we found to be the sole significant factor for success in our series. Yet, we had 3 cases with re-detachment despite laser retinopexy. Previous studies reported that, new breaks were mostly found in the lower or previously uninvolved quadrants.[14-16] This should not be surprising according to the aforementioned hypothesis. Investigating novel breaks causing failure were beyond the scope of this manuscript.

On the other hand, we had one patient who developed RD at 9 months following PR. This re-detachment occurred due to a fresh break next to the prior one. The second break was surprising for us, as the patient already had 360-degree laser retinopexy. Perhaps, one should not consider this case as a failure. Mudvari et al, reported that retinal re-detachment occurred mostly in the first 4 weeks after PR.[14] Yet, it should be remembered that, re-detachment can occur in the first year of the surgery.[17]

We did not encounter any PVR cases in our success group. Vitreomacular interface abnormalities – particularly ERM – is an expected complication of PR.[1] However, none of our cases developed ERM. The outcome of PPV in previously failed PR is beyond the scope of this manuscript and would be the issue of another study.

There is a controversy whether lattice degeneration interferes with outcome in PR. Lattice degeneration larger than 3 clock-hours was reported to be associated with failure due to extensive vitreoretinal adhesions.[18] On the other hand, there are opposite reports, suggesting lattice degeneration is not associated with unfavorable outcome.[8,17,19] In our series, we did not take lattice degeneration into account while deciding on the surgical aspect. Perhaps, it is a shortcoming of our manuscript.

The retrospective nature and the small sample size are the main limitations of our study. Our clinic is a tertiary referral center, we usually see complex RRD cases with significant PVR; this could make bias while deciding the treatment of choice. Another limitation is that, in our study, we did not consider the duration of detachment; one should expect that the longer duration of symptoms would be associated with the worse the outcome.

In conclusion, PR is an optimal surgical option for selected RRD cases. It has reasonable rate of favorable outcome on the expense of limited discomfort, adverse effects or complications.

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