

Indications and Outcome of Pars Plana Vitrectomy in Geriatric Patients

Geriatrik Olgularda Pars Plana Vitrektomi Endikasyonları ve Sonuçları

Güner Özkan ÜNEY¹, Nurten ÜNLÜ², Mehmet Akif ACAR³, Dicle HAZIROLAN², Züleyha YALNIZ AKKAYA², Firdevs ÖRNEK¹

ABSTRACT

Purpose: To evaluate the indication variety of pars plana vitrectomy (PPV) in the geriatric age group and to analyze the anatomical and functional outcome.

Material and Methods: The medical records of 152 eyes that underwent PPV were retrospectively reviewed. The baseline characteristics and anatomical and functional outcomes were analyzed. The surgical indications were grouped and evaluated individually. Additionally, the patients over 80 years old were evaluated and compared with the younger geriatric group.

Results: The most common indication for PPV was RD (42.4%). The single operation success rate was 74.3%, and after further operations, the final anatomic success rate was 86.8%. The difference of preoperative best corrected visual acuity (BCVA) ($2,1 \pm 0,54$ logMar) and the final BCVA ($1,29 \pm 0,77$ logMar) was statistically significant. Visual acuity of 20/200 or better was achieved in 51.3% of the cases. There was no statistically significant difference between the super geriatric and younger geriatric groups according to the anatomical and functional success rates.

Conclusion: Pars plana vitrectomy, has favorable prognosis in both super geriatric and younger geriatric groups.

Key Words: Pars plana vitrectomy, geriatrics, retinal detachment

ÖZ

Amaç: Geriatrik yaş grubunda pars plana vitrektomi endikasyonunun çeşitliliğini incelemek ve anatomik ve fonksiyonel sonuçları analiz etmek.

Gereç ve Yöntemler: Pars plana vitrektomi uygulanan 152 gözün kayıtları geçmişe dönük olarak değerlendirildi. Temel özellikler ve anatomik ve fonksiyonel sonuçlar analiz edildi. Cerrahi endikasyonlar ayrıca gruplandırıldı ve değerlendirildi. Ek olarak 80 yaş üstü hastalar incelendi ve erken geriatrik grup ile karşılaştırıldı.

Bulgular: Pars plana vitrektomi için en sık endikasyonu retina dekolmanı idi (%42,4). Tek operasyon başarı oranı %74,3 idi ve ilave operasyonlarda sonuç anatomik başarı oranı %86,8 idi. Cerrahi öncesi en iyi düzeltilmiş görme keskinliği (EİDGK) ($2,1 \pm 0,54$ logMar) ve sonuç EİDGK ($1,29 \pm 0,77$ logMar) arasındaki fark istatistiksel olarak anlamlı idi. Olguların %51,3'ünde 20/200 ve üzerinde görme keskinliği elde edilebildi. İleri geriatrik yaş ve erken geriatrik yaş arasında fonksiyonel ve anatomik başarı oranları arasında istatistiksel fark yoktu.

Sonuç: Pars plana vitrektomi, erken ve geç dönem geriatrik hasta grubunda anatomik ve görsel açıdan olumlu prognoza sahiptir.

Anahtar Sözcükler: Pars planan vitrektomi, geriatri, retina dekolmanı.

1- Uz. Dr., SB Ankara Eğitim ve Araştırma Hastanesi, Göz, Ankara - Türkiye

2- Doç. Dr., SB Ankara Eğitim ve Araştırma Hastanesi, Göz, Ankara - Türkiye

3- Prof. Dr., Yıldırım Beyazıt Üniversitesi, Göz Hastalıkları Anabilim Dalı, Göz, Ankara - Türkiye

Geliş Tarihi - Received: 08.12.2016

Kabul Tarihi - Accepted: 13.12.2016

Ret-Vit 2017; 26: 294-300

Yazışma Adresi / Correspondence Address:

Güner Özkan ÜNEY
Ankara Eğitim ve Araştırma Hastanesi, Göz Hastalıkları,
Ankara - Türkiye

Phone: +90 312 595 3482

E-mail: guner_ozkan@yahoo.com

INTRODUCTION

With the rise in the expected life span, the proportion of the elderly age group in the community increases.¹ Therewithal, the super geriatric group over 80 years of age is growing. Diseases of the eye, like age-related macular degeneration, diabetic retinopathy (DR), and cataracts, are more prevalent in the elderly.^{2,3} Thus, the aging process of the eye and coexisting medical illnesses cause an individual group spectrum of surgery indications.

Pars plana vitrectomy (PPV) is a procedure that has been practiced for a long time among those in a large indication group.⁴ A significant proportion of this indication variety is prevalent among the elderly.

Previous studies report the indication and outcomes of PPV in broad age groups. Nevertheless, to the best of our knowledge, the geriatric age group has not been reviewed separately.

The aim of this study is to identify the indications of PPV in the elderly age group and to evaluate the anatomical and functional outcome of the surgery. The super geriatric patients are analyzed and summarized separately as a subgroup.

MATERIALS AND METHODS

This is a retrospective study on a consecutive series of patients who underwent PPV. Institutional review board\ethics committee approval was obtained. The medical records of patients over 65 years old who underwent PPV from January 2005 to December 2013 were reviewed.

Patients underwent a complete ophthalmoscopic examination. The age, gender, laterality, existing ophthalmologic disease, existing systemic disease, etiology of the surgery, preoperative best corrected visual acuity (BCVA), and BCVA at 1 month, 3 months, 6 months, and the final BCVA were documented. Visual acuity (VA) was measured on Snellen charts and was converted to the logarithm of the minimal angle of resolution (logMar). The number of additional surgical processes and the postoperative complications were recorded. Cases having follow-up period less than 6 months were excluded.

The operations were performed by 2 vitreoretinal surgeons (MAA and NÜ). A standard 20 gauge three-port PPV was performed. In retinal detachment (RD) cases, after the core vitrectomy, vitreous attachments were removed, and the subretinal fluid was drained using perfluorocarbon liquid or retinotomy related to the surgeons' preference. Endolaser was used at 360 degrees and around the tears and retinotomy. In eyes with tractional RD, after membrane dissection, homeostasis was achieved and endolaser was applied. Finally, in the case of necessity, fluid-air exchange was followed

by a gas (SF6 or C3F8) or silicone oil tamponade with a viscosity of 1000 centistokes.

In cases with vitreoretinal surface pathology (epiretinal membrane, macular hole), trypan blue was used to identify and remove the membrane. At the end of the surgery, fluid-air exchange was followed by a gas tamponade if necessary.

The retained lens material was removed after core vitrectomy and with the help of perfluorodecaline, either by vitrectomy probe or phacofragmatome. The hard lens material was extracted through the limbal approach.

The surgical indications were grouped and evaluated individually according to their anatomic and functional outcomes.

Patients between 65-79 years old and patients older than 80 years (super geriatric) were evaluated separately according to the anatomic and functional outcome, surgical indications, and postoperative complications.

Statistical analyses were performed using SPSS for Windows 16 (SPSS Inc. Chicago, USA). Descriptive statistics were expressed as mean \pm standard deviation or median (minimum-maximum) for continuous variables and frequency (%) for categorical variables. The groups were compared using the Mann-Whitney U test for continuous variables, using a Chi-square test for categorical variables and using the Wilcoxon Signed Ranks Test for paired samples; $p < 0.05$ was considered statistically significant.

RESULTS

This study included 152 eyes of 152 patients that underwent PPV. The mean age of the 87 (57.2%) (range:65-90 years) men and 65 (42.8%) women was 72.5 ± 6.3 years. The mean follow-up time was 14.8 ± 15.7 (range: 6-116) months. The baseline characteristics of the patients were summarized in Table 1.

The most common indication of PPV was RD (41.4%). The second indication mostly observed was complications due to the cataract surgery (Table 2).

The preoperative, 1st month, 3rd month, 6th month, and final mean BCVA were $2,1 \pm 0,54$ logMar, $1,39 \pm 0,71$ logMar, $1,35 \pm 0,72$ logMar, $1,39 \pm 0,68$ logMar and $1,29 \pm 0,77$ logMar, respectively. The visual acuity increased statistically significant when compared with preoperative BCVA ($p < 0.001$ at 1, 3, 6 months and final follow-up). The mean BCVA progress regarding the groups individually is shown in Figure 1.

Preoperatively, 89.5% of the cases had a BCVA less than 20/200, 9.9% of the eyes had BCVA of 20/200-20/50, and 0.7% had a BCVA equal to or better than 20/50. The final BCVA was less than 20/200 in 48.7% of the eyes, 20/200-20/50 in 32.2% of the eyes, and 20/50 and better in 19.1% of the eyes. The distribution of preoperative and final BCVA

Table 1. Baseline characteristics of the geriatric patients who underwent pars plana vitrectomy according to surgical indications.

	Retinal detachment	Cataract surgery complications	Retinal vein occlusion	Diabetic eye disease	Vitreoretinal pathology	Trauma	Other
Age (mean ± SD)	71,8 ± 5,3	75,7±6,5	69,81±4,3	70,11±2,7	70,4±7,2	80,3±8,7	73,5±10,2
Gender (men/women) (n) (%)	42/21 (66.7/33.3)	25/28 47.2/52.8	5/9 35.7/64.3	6/3 66.7/33.3	4/1 80/29	2/2 50/50	3/1 75/25
Follow up (months) (mean ± SD)	14,5±17,3	9,1±13,9	12,3±12	14,67±15	11±20,7	8,8±9,1	16,5±11,5
Laterality (right/left) (n) (%)	34/29 54/46	34/19 64.2/35.8	7/7 50/50	6/3 66.7/33.3	3/2 60/40	4/0 100/0	2/2 50/50
Lens (n) (%)							
Phakic	13 (20.6)	NA	7 (50)	4 (44.4)	2 (40)	NA	NA
Pseudophakic/aphakic	50 (79.4)	53 (100)	7 (50)	5 (55.6)	3 (60)	4 (100)	4 (100)

Table 2. Preoperative surgical indications in geriatric patients.

Etiology	Patient (n)	%
Retinal detachment	63	41.4
Primary retinal detachment	34	22.4
Recurrent retinal detachment ^a	29	19.1
Cataract surgery complications	53	34.9
Retained lens fragments	44	28.9
Endophthalmitis	5	3.3
IOL dislocation	4	2.6
Retinal vein occlusion	14	9.2
Diabetic eye disease	9	5.9
Vitreoretinal pathology	5	3.3
Trauma	4	2.6
Blunt	2	1.3
Penetrating	2	1.3
Other	4	2.4
Non-clearing vitreous hemorrhage	3	2
Vitreous hemorrhage secondary to choroid neovascularization	1	0.7

^aSecondary to scleral buckling surgery

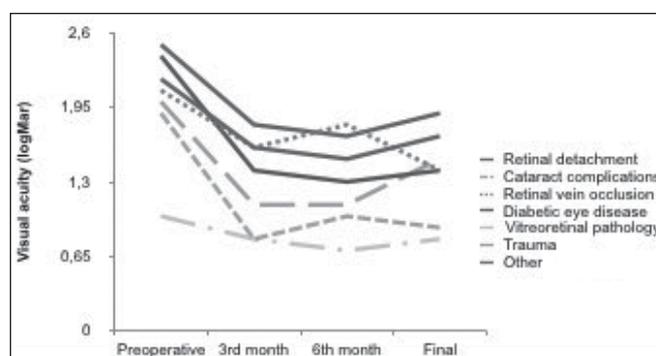
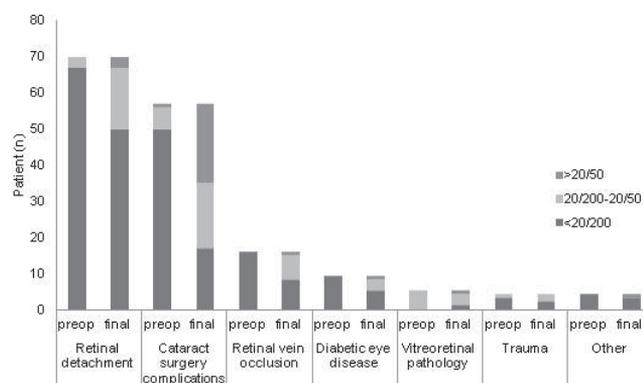
according to the visual categories in the surgery groups is demonstrated in Figure 2.

The single operation success rate (SOSR) was 74.3%, and after further operations, the final anatomic success rate was 86.8%.

Silicone oil was used in 50.7% of the eyes. In 17.9% of the eyes, C3F8 or SF6 was used.

The mean number of secondary surgical procedures performed after primary surgery was 0,43 (min: 0 max: 4).

The most common complications observed were retinal detachment (25.7%) and glaucoma (21.1%) (Table 3).

**Figure 1.** Visual acuity progress according to the surgical indications**Figure 2.** The distribution of preoperative and final visual acuities according to the visual categories in the surgery groups

The Super Geriatric Group

Twenty-seven (16.4%) of the cases were older than 80 years old. The distribution of the indications according to the age groups is demonstrated in Figure 3.

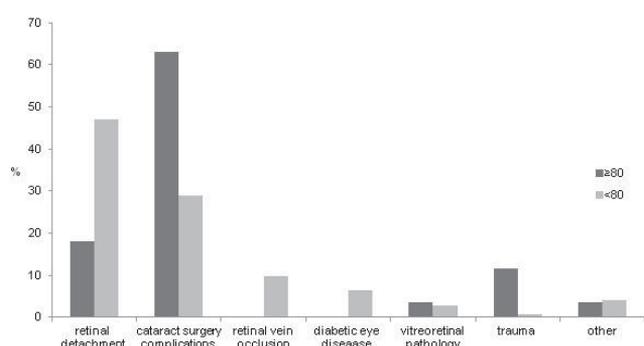
All of the eyes were pseudophakic/aphakic.

In the super geriatric group, the preoperative, 1st month, 3rd month, 6th month, and final BCVA were $1,87 \pm 0,73$ logMar,

Table 3. Postoperative complications and anatomic success rates according to the surgery indications.

	Retinal detachment (%)	Cataract surgery complications (%)	Retinal vein occlusion (%)	Diabetic eye disease (%)	Vitreoretinal pathology (%)	Trauma (%)	Other (%)
Retinal redetachment	34.9	20.8	14.3	NA	40	NA	50
Glaucoma	23.5	18.9	14.3	22.2	NA	25	50
Cataract ^a	100	NA	82.1	100	100	NA	NA
Corneal complications	7.9	1.9	NA	NA	NA	NA	NA
Optic atrophy	NA	3.8	NA	11.1	NA	NA	NA
Phthisis bulbi	3.2	NA	NA	NA	NA	NA	NA
Endophthalmitis	NA	1.9	NA	NA	NA	NA	NA
Anatomic success rate	79.4	94.3	92.9	77.8	100	100	75

^aFor phakic eyes

**Figure 3.** Distribution of the surgical indications according to the age groups

1,15±0,84 logMar, 1,1±0,79 logMar, 1,1±0,72 logMar and 1,13±0,88 logMar respectively ($p<0.001$ at 1, 3, 6 months and final follow-up).

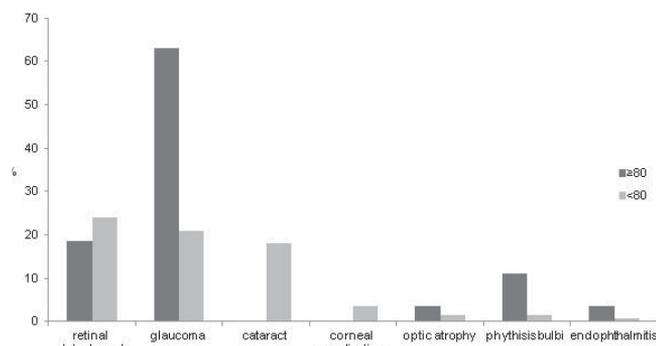
In the geriatric patients under 80 years old, the preoperative, 1st month, 3rd month, 6th month and final BCVA was 2,9±0,5 logMar, 1,43±0,68 logMar, 1,39±0,71 logMar, 1,42±0,67 logMar and 1,32±0,75 logMar, respectively ($p<0.001$ at 1, 3, 6 months and final follow-up).

The difference in the BCVA between the groups at each follow-up visit was not statistically significant ($p=0.19, 0.09, 0.15, 0.14, 0.26$, preoperatively, 1, 3, 6 months and final follow-up).

The most common complication in both age groups observed was RD (26.6%, 20.8% respectively, $p=0.38$, Chi-square) and glaucoma (21.1%, 20.8% respectively, $p=0.6$, Chi-square) (Figure 4).

The mean number of secondary surgical procedures performed after primary surgery was 0,21 (min: 0 max: 2) in the super geriatric patients and 0,61 (min:0 max:4) in geriatric patients under 80 years old ($p=0.01$, Chi-square).

Final anatomic success was achieved in 86.7% of the super geriatric group and 87.5% of the geriatric patients under 80 years old ($p=0.61$, Chi-square).

**Figure 4.** Distribution of complications according to the age groups

Retinal detachment

Primary and recurrent RD represented 54% and 46% of the cases, respectively.

The recurrent RD cases were all secondary to SB surgery.

In primary and recurrent RD groups, 79.4% and 79.3% of the cases, respectively, were pseudophakic/aphakic.

The single operation success rate (SOSR) was 67.7%. After further operations, the final anatomic success rate was 79.4%. In the primary RD group, the SOSR was 67.6%, and the final anatomic success rate was 76.5%. The SOSR of recurrent RD was 65.5% and final anatomic success rate was 82.8%.

Preoperatively, 95.2% of the eyes had a BCVA worse than 20/200, and the remaining eyes had a BCVA of 20/200-20/50. At the final follow-up, 68.3% of the cases had a BCVA worse than 20/200, 27% had a BCVA of 20/200-20/50, and 4.7% had a BCVA equal to or better than 20/50.

There was no statistically significant difference according to the complication rates except RD between the subgroups (phthisis bulbi $p=0.71$, corneal complications $p=0.58$, glaucoma $p=0.52$, cataract $p=0.59$, Chi-square). The rate of re-detachment observed was 43.6% in the primary RD group and 12.4% in the recurrent RD group ($p=0.006$, Chi-square).

Cataract surgery complications

Preoperatively, 86.8% of the eyes had a BCVA of worse than 20/200, 11.3% had a BCVA of 20/200-20/50, and 1.81.9% had a BCVA equal to or better than 20/50.

Of the eyes observed, 26.4% had a BCVA worse than 20/200, 32.1% of the eyes had a BCVA of 20/200-20/50 and 41.5% of the eyes had equal to or better than 20/50 finally.

Retinal vein occlusion

All of the eyes had VA of light perception or hand movements before the surgery. Furthermore, 42.9% of the eyes had a VA worse than 20/200 in and 7.1% of the eyes had VA equal to or better than 20/50.

Preoperatively, 31.2% of the eyes had tractional RD and 68.8% of the eyes were operated for non-clearing vitreous hemorrhage secondary to neovascularization .

Diabetic eye disease

All of the eyes had VA of light perception or hand movements before the surgery. At the final follow-up, the VA was worse than 20/200 in 55.6% of the cases and equal to or better than 20/50 in 11.1% of the cases.

Preoperatively, 55.6% of the eyes had tractional RD. Non-clearing vitreous hemorrhage was present in 44.4% of the eyes and were operated for this indication. In 2 eyes, tractional RD was finally resuming.

DISCUSSION

Visual impairment has been found to be related to depression and has a negative effect on the quality of life of the elderly age group.⁵ Accordingly, the surgical spectrum and outcome is important to bring out the improvement in the ophthalmologic care for this population.

The ophthalmological surgery indications change related to the alteration of the pathology by aging. In this study, due to the vast indication variety present, an assortment of surgical classifications was composed in order to evaluate the outcomes. Additionally, the subgroups with relatively larger case series were analyzed according to their anatomical and functional results.

In the literature, RD is reported to be the most frequent indication for vitreoretinal surgery. In the study by Paudyal et al., vitreoretinal surgery was performed mostly for RD and vitreous hemorrhage, with a mean age of 46.3.⁶ In the case series by Jackson et al., rhegmatogenous retinal detachment (RRD) and retinal tears were followed with macular holes in surgical indications.⁷ Other studies reported RD, diabetic eye disease, and macular hole surgery to be the most frequent indications.^{8,9}

The largest surgery groups in our study included cases operated on for RD and for complications related to cataract

surgery. The majority of the eyes that had RD were pseudophakic, which can be associated with cataract surgery complications. Notwithstanding, it would be beneficial to discuss the geriatric RD individually.

In literature, there are case series reporting the anatomical and functional outcomes of PPV performed for different indications in different age groups.⁶⁻⁹ Ah-Fat et al., reported a SOSR of 84.7% and a final success rate of 94.3%.⁸ In the study of Paudyal et al., the anatomical success rate was 74.5%.⁶ The SOSR in our case series was 74.3% and after further operations the final anatomical success rate reached to 86.8%. Although there are some differences according to the indication variety from previous studies of younger age groups, the anatomical success was comparable in our study.

Teke et al. reported a statistically significant increase in the mean VA from preoperatively 1.77 ± 0.58 logMAR to 1.06 ± 0.61 logMAR at sixth-month.⁹ In the study by Paudyal et al., postoperatively 39% of the patients experienced improved VA, with 33% obtaining >6/60 vision.⁶ The VA improved in geriatric age group from 2.1 ± 0.54 logMar to 1.39 ± 0.68 logMar at 6 months and to 1.29 ± 0.77 logMar at the final follow-up, which was statistically significant. Preoperatively, 89.5% of the cases had a BCVA of less than 20/200. At the final follow-up, 51.3% of the cases had a VA better than 20/200. The surgical success may differ related to the indication variety. Nevertheless, these results may show the overall benefit of PPV in this age group anatomically and functionally.

Age is reported to be a risk factor for RD. In elderly people, the incidence was observed from 15.21 to 50 per 100,000 in different studies.^{10,11} In addition to the risk comprised by age factor, the rate of eyes that underwent cataract surgery increases with one's age, an aspect also related with RD. Stein et al. reported a one-year postoperative rate of RRD 0.26%.¹² Erie et al. reported that the cumulative probability ratio was four times higher at 20 years after cataract surgery than among eyes not undergoing cataract extraction.¹³ There was a rise in the proportion of patients with RRD following cataract surgery (from 19.5% to 29.5%) according to the study by Ah-Fat et al.⁸ In our study, in the elderly age group, RD was the most frequent indication for PPV, similarly for the subgroup that consisted of the super geriatric age. Furthermore, 79.4% of the cases had undergone cataract surgery previously, which could have brought along the increased incidence of RD.

In the literature, studies reported a SOSR between 62.6 - 92% for PPV or PPV/SB.¹⁴⁻¹⁷ We observed in elderly patients that the anatomical results were compatible with previous studies. The SOSR was 67.7%, and after further operations, the final anatomical success rate reached 79.4%. The cases are not evaluated according to their complexity and the duration of primary symptoms or macular involvement, since the aim

of the study was to evaluate the indication and outcome of PPV. Therefore, to compare the success rates, randomized prospective studies are necessary to clarify the aspect of the primary and secondary surgeries performed for RRD in geriatric patients.

In RRD surgery, it has been proposed that up to 40% of treated patients have a VA of 20/50 or worse.^{18,19} Some studies found no relationship between age and inferior visual results.^{20,21} Ma et al. reported that the increase in BCVA in geriatric patients was compatible with the literature involving younger age groups.²¹ Inversely, various studies reported advanced age to be an adverse prognostic factor for visual recovery.^{22,23} In our study, although there was a statistically significant increase in VA, 68.3% of the cases had a VA of worse than 20/200. Factors including macular involvement, extend of RD, duration of symptoms, preoperative VA, and coexisting ocular pathologies should be assessed in addition to the age factor to evaluate the surgery in the geriatric age and be compared with the younger age groups in prospective studies.

Pars plana vitrectomy performed for cataract surgery complications was the second most common indication for the whole study group and the most common indication in the super geriatric age group. As the life expectancy increased, cataracts are becoming more prevalent.³ In the aged population group in connection with the increased cataract surgery, the complication rate is expected to be higher. In this age group, cataract surgery is challenging due to the patients' medical conditions and lack of cooperation and in consequence of the dense nuclear cataracts.²⁴ We observed that the most frequent cataract surgery complications are retained lens fragments. In different studies, the rate of PPV performed for retained lens fragments is reported between 2.7-5.5%.⁷⁻⁹ In the geriatric age group, this rate reached 34.9%, as expected in connection with the difficulty of the cataract surgery.

Half of the cases of retinal vein occlusion were observed in the age group of 65 years or older.²⁵ The rate of PPV performed for the complications of retinal vein occlusion is reported between 0.8-7.8% in different studies.^{6,7,9} In the geriatric age group, this rate reached 9.2% related to the frequency of the disease. The mean age of the group was 69.3 years. Over 80 years of age, there were no cases operated for retinal vein occlusion complications in our case series. The final VA was equal to or better than 20/200 in 42.9% of the eyes, which is worse than previously reported.²⁶ This can be explained by the poor preoperative VA, which was light perception or hand movements, in all of the eyes.

According to the Eye Diseases Prevalence Research Group in diabetics aged 65-74 years, DR prevalence is 45%, and after 75 years, the prevalence is 42%.²⁷ In geriatric patients over 70 years of age, the progression to proliferative forms

is reported to be at a lower rate.²⁸ In the literature, the rate of PPV performed for diabetic eye disease is reported between 7-29.5% in all vitreoretinal surgery groups.^{6,7,9} This rate was found to be 5.9% in our study and was the fourth most common indication group for PPV. In the super geriatric age group, diabetic eye disease was not an indication for PPV.

The vitreoretinal interface disorders do not seem to be a frequent indication in the elderly population in our series. Late diagnosis and poor functional success expectations, relatively good vision at the time of diagnosis which may seem to be sufficient for the patient, expectations of ambulatory vision without surgical intervention, and coexisting systemic disorders may be reasons for delaying PPV in the elderly population.

As the demographic trends persist, the age group over 80 years is expected to increase, and the requirement of ophthalmologic care for this rapidly growing age group will rise. Consequently, we aimed to evaluate this subgroup with regard to PPV indications and outcomes. The indication variety was not different, except in regard to the complications of retinal vein occlusion and diabetic eye disease on account of the incidence of these diseases in this age group. The visual and anatomical outcome was not different from the younger geriatrics statistically; nevertheless, prospective studies among large study groups are necessary to analyze the outcome of vitreoretinal surgery in super geriatric patients.

In summary, this study revealed that the most common indications of PPV were related to cataract surgery complications. The indication variety had some differences from previous studies with regard to the changing spectrum of the eye pathology. The overall success rates were compatible with the younger age groups reported in the literature. In the super geriatric age group, the functional and anatomic outcome was not different from that of the younger geriatric age.

REFERENCES / KAYNAKLAR

1. Department of Economic and Social Affairs (Population Division), United Nations. World Population Prospects: The 2012 Revision. <http://esa.un.org/wpp/>. Accessed 1 Oct, 2014.
2. Podger, MJ, Leske, MC, Ederer F. Incidence estimates for lens changes, macular changes, open angle glaucoma and diabetic retinopathy. *Am J Epidemiol.* 1983;118:206-12.
3. Klein BE, Klein R, Linton KL. Prevalence of age-related lens opacities in a population. The Beaver Dam Eye Study. *Ophthalmology.* 1992;99:546-52.
4. Machemer R, Parel JM, Norton EW. Vitrectomy: a pars plana approach. Technical improvements and further results. *Trans Am Acad Ophthalmol Otolaryngol.* 1972;76:462-6.
5. Evans JR, Fletcher AE, Wormald RP. Depression and anxiety in visually impaired older people. *Ophthalmology.* 2007;114:283-8.
6. Paudyal G, Doshi V, Shrestha MK, Kalayoglu MV, Tabin G, Guring R, et al. Treatment of vitreoretinal disorders in the developing world: indications and outcomes of vitreoretinal surgery in Nepal. *Ophthalmology.* 2005;112:319-26.

7. Jackson TL, Donachie PH, Sparrow JM, Johnston RL. United Kingdom National Ophthalmology Database Study of Vitreoretinal Surgery: report 1; case mix, complications, and cataract. *Eye (Lond)*. 2013;27:644-51.
8. Ah-Fat FG, Sharma MC, Majid MA, McGalliard JN, Wong D. Trends in vitreoretinal surgery at a tertiary referral centre: 1987 to 1996. *Br J Ophthalmol*. 1999; 83:396-8.
9. Teke MY, Balikoglu-Yilmaz M, Yuksekkaya P, Citirik M, Elgin U, Ozdal P, et al. Thirteen-year vitreoretinal surgical outcomes of 5,097 cases from a tertiary referral center in Turkey. *Ophthalmologica*. 2013;230:186-94.
10. Mitry D, Charteris DG, Fleck BW, Campbell H, Singh J. The epidemiology of rhegmatogenous retinal detachment: geographical variation and clinical associations. *Br J Ophthalmol*. 2010;94: 678-84.
11. Van de Put MA, Hooymans JM, Los LI; Dutch Rhegmatogenous Retinal Detachment Study Group. The incidence of rhegmatogenous retinal detachment in The Netherlands. *Ophthalmology*. 2013;120: 616-22.
12. Stein JD, Grossman DS, Mundy KM, Sugar A, Sloan FA. Severe adverse events after cataract surgery among medicare beneficiaries. *Ophthalmology*. 2011;118:1716-23.
13. Erie JC, Raecker ME, Baratz KH, Schleck CD, Robertson DM. Risk of retinal detachment after cataract extraction, 1980– 2004: a population-based study. *Trans Am Ophthalmol Soc*. 2006; 104: 167-75.
14. Mendrinos E, Dang-Burgener NP, Stangos AN, Sommerhalder J, Pournaras CJ. Primary vitrectomy without scleral buckling for pseudophakic rhegmatogenous retinal detachment. *Am J Ophthalmol*. 2008;145:1063-70.
15. Afrashi F, Erakgun T, Akkin C, Kaskaloglu M, Mentis J. Conventional buckling surgery or primary vitrectomy with silicone oil tamponade in rhegmatogenous retinal detachment with multiple breaks. *Graefes Arch Clin Exp Ophthalmol*. 2004;242:295-300.
16. Ahmadi H, Moradian S, Faghihi H, Parvaresh MM, Ghanbari H, Mehryar M, et al. Anatomic and visual outcomes of scleral buckling versus primary vitrectomy in pseudophakic and aphakic retinal detachment: six-month follow-up results of a single operation. Report no. 1. *Ophthalmology* 2005;112:1421-9.
17. Tewari HK, Kedar S, Kumar A, Garg SP, Verma LK. Comparison of scleral buckling with combined scleral buckling and pars plana vitrectomy in the management of rhegmatogenous retinal detachment with unsewn retinal breaks. *Clin Experiment Ophthalmol*. 2003;31:403-7.
18. Christensen U, Villumsen J: Prognosis of pseudophakic retinal detachment. *J Cataract Refract Surg*. 2005;31:354-8.
19. de Silva DJ, Kwan A, Bunce C, Bainbridge J. Predicting visual outcome following retinectomy for retinal detachment. *Br J Ophthalmol*. 2008;92:954-8.
20. Heussen N, Feltgen N, Walter P, Hoerauf H, Hilgers RD, Heimann H; SPR Study Group. Scleral buckling versus primary vitrectomy in rhegmatogenous retinal detachment study (SPR Study): predictive factors for functional outcome. Study report no. 6. *Graefes Arch Clin Exp Ophthalmol* 2011;249: 1129-36.
21. Ma Y, Ying X, Zou H, Xu X, Liu H, Bai L, et al. Rhegmatogenous retinal detachment surgery in elderly people over 70 years old: visual acuity, quality of life, and cost-utility values. *PLoS One*. 2014. doi: 10.1371/0110256.
22. Mowatt L, Shun Shin GA, Arora S, Price N. Macula off retinal detachments. How long can they wait before it is too late? *Eur J Ophthalmol* 2005;15:109-17.
23. Pastor JC, Fernandez I, Rodríguez de la Ru' a E, Coco R, Sanabria Ruiz Colmenares MR, Sánchez-Chicharro D, et al. Surgical outcomes for primary rhegmatogenous retinal detachments in phakic and pseudophakic patients: the Retina 1 Project– report 2. *Br J Ophthalmol* 2008;92: 378-82.
24. Syam PP, Eleftheriadis H, Casswell AG, Brittain GP, McLeod BK, Liu CS. Clinical outcome following cataract surgery in very elderly patients. *Eye*. 2004;18:59-62.
25. Hayreh SS, Zimmerman MB, Podhajsky P. Incidence of various types of retinal vein occlusion and their recurrence and demographic characteristics. *Am J Ophthalmol*. 1994;15:117:429-41.
26. Amirikia A, Scott IU, Murray TG, Flynn HW Jr, Smiddy WE, Feuer WJ. Outcomes of vitreoretinal surgery for complications of branch retinal vein occlusion. *Ophthalmology*. 2001;108:372-6.
27. Kempen JH, O'Colmain BJ, Leske MC, Haffner SM, Klein R, Moss SE, et al. The prevalence of diabetic retinopathy among adults in the United States. *Arch Ophthalmol* 2004;122:552-63.
28. Kato S, Takemori M, Kitano S, Hori S, Fukushima H, Numaga J, et al. Retinopathy in older patients with diabetes mellitus. *Diabetes Res Clin Pract* 2002;58:187-92.