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Risk factors for redetachment and worse visual outcome after silicone oil removal in eyes with complicated retinal detachment

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PURPOSE. *The goal of this study was to identify risk factors for redetachment and/or a worse visual outcome after silicone oil removal (SOR) for complicated retinal detachment.*
METHODS. *The authors retrospectively analyzed 287 consecutive eyes with SOR between January 1999 and December 2003.*
RESULTS. *Anatomic success after SOR was achieved in 81% of the eyes. The overall anatomic success at the end of follow-up was 94%. Postoperative ocular hypertension was found in 8% of the eyes, hypotony in 6% of the eyes, and keratopathy in 29% of the eyes. After SOR 43% of the eyes had an improvement in visual acuity of at least two Snellen lines. After multivariate analysis, male sex, the presence of preoperative rubeosis, and proliferative diabetic retinopathy (PDR) were found to be risk factors for recurrent retinal detachment. Male sex, preoperative visual acuity of <0.1 Snellen lines, PDR, the performance of three more operations, any size of retinectomy, and hypotony were found to be associated with a poor visual outcome of Snellen visual acuity <0.1.*
CONCLUSIONS. *Retinal detachment after SOR in the current unselected series of eyes occurred in approximately 20%, which is comparable to the Silicone Oil Study reports, published approximately 20 years ago. However, preoperative selection was then made, and less than 50% of the silicone oil–filled eyes had SOR. The higher overall anatomic success in the current study may be due to improved vitreoretinal surgical techniques. (Eur J Ophthalmol 2007; 17: 627-37)*

KEY WORDS. *Silicone oil removal, Visual outcome, Redetachment, Risk factors, Hypotony, Complicated retinal detachment, Vitreoretinal surgery*

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INTRODUCTION

Silicone oil is a commonly used agent in the management of complicated retinal detachment (RD). Because of the risk of complications due to the use of silicone oil, the tamponade is often temporary. Complications of silicone oil injection include cataract, glaucoma, keratopathy, and oil emulsification (1-9). Visual outcome, recurrent RD, and the incidence of these complications varies considerably in the literature (1-3, 6-8, 10-13). A complication of silicone oil removal (SOR) is hypotony (4). Furthermore, different preoperative and operative factors are reported as risk factors for recurrent RD and poor visual outcome and for the development of complications (6, 10-12, 14).
To identify which patients have better operative results after SOR, it is important to analyze which pre-, per-, and postoperative clinical variables are associated with anatomic failure and a worse visual outcome. The goal of this study therefore was to analyze a consecutive series of eyes that underwent SOR after complicated RD surgery and to identify which clinical variables were associated with redetachment and/or a worse visual outcome. In ad-

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dition, we identified which of these clinical variables may be associated with an increased risk for glaucoma, keratopathy, and hypotony.

PATIENTS AND METHODS

We retrospectively reviewed the charts of all patients who underwent SOR (n=278) in the Academic Hospital of Maastricht between January 1999 and December 2003. A total of 210 eyes with proliferative vitreoretinopathy (PVR), 27 eyes with trauma, 26 eyes with giant tears, and 13 eyes with traction RD due to proliferative diabetic retinopathy (PDR) were included. We excluded eyes with retinopathy due to prematurity. Only eyes with a minimum follow-up of 3 months were included.

In a retrospective manner the following information was gathered: age, sex, duration of silicone oil tamponade, follow-up time, diagnosis and original indication for silicone oil injection, ocular history including all previous surgery, intraocular pressure, or trauma, and whether there was a history of systemic disease. Pre- and postoperative best-corrected Snellen visual acuity (VA) and pre- and postoperative Goldmann applanation tonometry were recorded. All possible causes of a poor postoperative VA were noted such as macular degeneration, macular hole, cystoid macular edema, intraocular pressure, or optic atrophy. During slit-lamp examination the following were described: the presence of keratopathy, the presence of silicone oil in the anterior chamber and the amount of oil filling, whether the silicone oil showed a strong emulsification, the presence of any neovascularization of the iris, and the status of the lens. Funduscopy was performed using indirect binocular ophthalmoscopy, with a Goldmann three-mirror contact lens, and with a panfundus contact lens (Supersquad 160°). The following data were collected postoperatively: the presence of an encircling band, the cumulative size of all retinectomies performed in that eye, and whether there was a stable but persistent peripheral RD at the moment of oil removal. Proliferative vitreoretinopathy (PVR) was graded according to the Retina Society classification of 1983 (15).

In our clinic, cases with up to PVR grade C1 are operated using a conventional scleral buckling technique (6, 16). Eyes with a poor funduscopic view, as in miosis and/or with a larger vitreous hemorrhage, central, and complex tears at various distances from the vitreous base, PVR grade C2 and higher, and trauma cases with PVR are operated on with a primary vitrectomy. All operations were performed by three surgeons (E.L.H., F.H., or A.L.). Our vitrectomy technique with silicone oil tamponade included the following: a standard three-port vitrectomy with a trocar microcannular system (Grieshaber & Co, AG, Schaffhausen, Switzerland) using a noncontact wide angle panoramic viewing system (BIOM). The scleral buckle was always left in place, and vitreous removal was as complete as possible, with shaving of the vitreous base. The retina was mobilized by removing all epi- and subretinal membranes and strings, and performing relaxing retinectomies as a last resort, only in cases in which the retina remained rigid. Lensectomy was only carried out in eyes with anterior PVR, as described in the Silicone Study Report number 10 (17) to completely clean the peripheral retina and vitreous base. All cases were operated with the use of perfluorocarbon liquid (DK-line, Chauvin Opsia, France) which was exchanged for silicone oil (1000 centistokes). Reoperations were performed until a stable attached retina was obtained central of the encircling element. When a partial peripheral RD existed, i.e., anterior to the encircling scleral buckle, this was treated locally with argon laser confinement, as described earlier (18), until a stable situation was obtained allowing the removal of silicone oil.

Indications for the removal of silicone oil were a stable situation with an attached retina posterior to the encircling scleral buckle or complications such as ocular hypertension, keratopathy, or oil-corneal touch, as described earlier (6). Our technique of SOR was through two corneoscleral incisions in case of aphakia, or through two pars plana sclerotomies. When additional procedures had to be carried out, such as endolaser photocoagulation, lensectomy by phacofragmentation or phacoemulsification, removal of epiretinal membranes, or removal of ischemic edges of former retinectomies, a three-port vitrectomy was performed.

For the purpose of this study, recurrent RD after SOR was defined either as a complete retinal redetachment or as a local detachment. Anatomic success was defined as an attachment of retina between the photocoagulation barrier at the end of the follow-up period. For follow-up, all patients were seen at regular intervals of 3 to 4 weeks. A clinically significant change in VA was defined to be at least two lines of Snellen acuity (e.g., a change from light perception to hand movements, or from finger counting to 0.1, and vice versa) measured at the last follow-up visit. We used the following definitions for outcome and com-

plications, as described earlier (6). Because in this retrospective study there were incomplete data available on visual field defects and the presence of optic disc cupping, we used the definition of glaucoma as defined earlier in the Silicone Oil Study Group report no. 6 (19), i.e., glaucoma was defined as an intraocular pressure of more than 25 mm Hg, or more than 20 mm Hg with antiglaucoma medication (19), measured at any time during follow-up (19). Since this definition applies more to ocular hypertension because it does not take into account whether there were any related morphofunctional optic nerve changes, we replaced the word glaucoma for ocular hypertension, but adhered to the original definition of the earlier mentioned Silicone Oil Study Group report no. 6 (19). Hypotony was defined as intraocular pressure of less than 5 mm Hg (19). Keratopathy was defined as a bullous- or band-shaped keratopathy, epithelial- or stromal edema, or localized opacities, as defined in the Silicone Study Report no. 6 (19).

Statistical analyses were performed with SPSS version 12.0. Snellen visual acuities were converted to a logarithmic scale (logMAR, i.e., the logarithm of the minimal angle of resolution), as described earlier (20). Comparisons between preoperative and postoperative visual acuities were made using the Wilcoxon signed rank test. Univariate analysis was performed with the Pearson chi-square exact test to determine if the preoperative clinical variables were associated with the postoperative redetachment, complications such as ocular hypertension, hypotony, and the visual outcome. Secondly, a stepwise forward conditional multiple logistic regression analysis was used for the following preoperative variables to determine the strongest predictors of postoperative redetachment, complications, and visual outcome, using a probability for PDR, three or more operations, PVR, trauma, giant tear, any retinectomy performed, and the presence of rubeosis.

RESULTS

Whole study group

The study included 287 eyes of 280 patients. Of the 287 eyes, 199 were male (69%) and 88 were female (31%). The mean age was 56.6 years (SD±14.8). For the 287 eyes the mean follow-up time was 21.2 months (SD±16.6). The mean duration of silicone tamponade was 10.0 months (SD±6.9) and the mean number of surgical procedures before oil removal was 1.2 (SD±0.5).

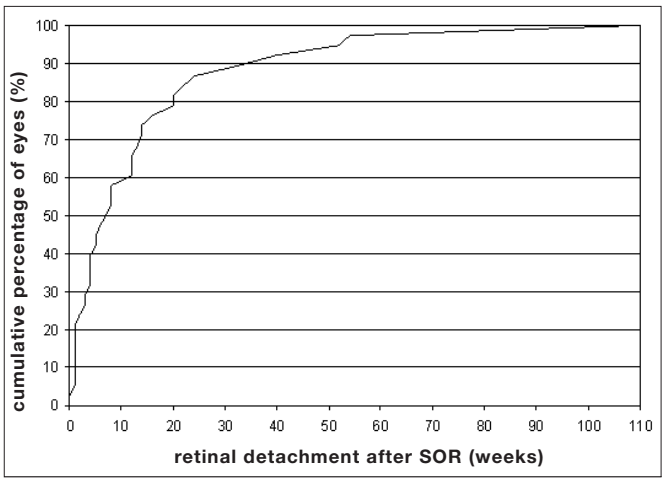

Fig. 1 - *Cumulative percentage of patients (n=38) with retinal redetachment after silicone oil removal.*

The causes of complicated RD were PVR in 210/287 eyes (73%), trauma in 27/287 eyes (9%), giant tear in 26/287 eyes (9%), and traction RD due to PDR in 13/287 eyes (5%). Eleven eyes (4%) had a complicated RD associated with an earlier intraocular surgical procedure, such as vitrectomy for of retained lens fragments or a macular hole surgery.

Anatomic success

Anatomic success was achieved in 233/287 eyes (81%), whereas after SOR 54/287 eyes (19%) had a redetachment of the retina. In the 54 eyes that developed a recurrent RRD, data on time and cause of the redetachment after SOR were available in 38 eyes. The retina redetached 0 to 108 weeks after SOR (Fig. 1), with mean period of 14.3 weeks (SD±20.6). Within the first 3 months after the SOR 26/38 eyes (68%) had a retinal redetachment and within the first 6 months 33/38 eyes (87%) had a redetachment. After 1 year, another 3/38 eyes (8%) developed a redetachment. Twenty-one of the 26 eyes that developed a redetachment within 3 months were due to reopening of old retinal defects or formation of new defect because of membrane proliferation attributable to PVR. At the end of the follow-up period five other eyes had a redetachment due to reopening of old retinal defects or formation of new defects. After the redetachment 21/38 eyes (55%) underwent a vitrectomy with oil tamponade. Eight of 21 eyes (38%) had another SOR and 13/21 eyes (62%) had oil tamponade at the end of the follow-up period. In 17/38

TABLE I - CLINICAL VARIABLES ASSOCIATED WITH REDETACHMENT BY UNIVARIATE AND MULTIVARIATE ANALYSIS: AFTER THE COMPLETE FOLLOW-UP PERIOD OF MORE THAN 36 MONTHS

Factors	Total, n=287	Retina redetached n=54 (8.8%), n (%)	Univariate analysis, p value	Multivariate analysis, p value
Preoperative				
Age, yr				
≤70	234	43 (18.4)	NS	NS
>70	53	11 (20.8)		
Gender				
Male	199	31 (15.6)	0.048	0.034
Female	88	23 (26.1)		
Visual acuity (Snellen) preoperative				
<0.1	187	40 (21.5)	0.054	NS
≥0.1	100	12 (12.1)		
Rubeosis preoperative				
Yes	21	8 (38.1)	0.026	0.007
No	266	46 (17.3)		
PDR pre-SOR				
Yes	13	7 (53.8)	0.004	0.001
No	274	47 (17.2)		
Operations				
<3	180	29 (16.1)	NS	NS
≥3	107	25 (23.4)		
Amount of SOR				
<3	278	53 (19.1)	NS	NS
≥3	9	1 (11.1)		
Tamponade, mo				
<6	79	15 (19.0)	NS	NS
≥6	208	39 (18.8)		
SOR procedure				
Pars plana	182	37 (20.3)	NS	NS
Anterior chamber	105	17 (16.2)		
Encircling band present				
Yes	214	36 (16.8)	NS	NS
No	69	17 (24.6)		
Retinectomy				
Yes	118	26 (22.0)	NS	NS
No	169	28 (16.6)		

NS = Not significant; PDR = Proliferative diabetic retinopathy; SOR = Silicone oil removal

eyes (45%), the patients and/or the surgeon decided not to perform any further operations because of poor physical condition of the patient or poor prognosis. Three eyes needed enucleation because of intractable pain and function loss.

The overall anatomic success at the end of follow-up was 265/282 eyes (94%). Results of all pre- and postoperative variables, at the end of the follow-up period, tested for their association with redetachment by univariate analysis are presented in Table I. After multivariate analysis, only the variables male sex, the presence of rubeosis, and PDR were significantly associated with recurrent RD (p=0.034, p=0.007, and p=0.001, respectively).

Visual acuity

VA results pre- and postoperatively for the whole group are presented in Table II. VA at 3 months postoperative and 12 months postoperative was significantly better than

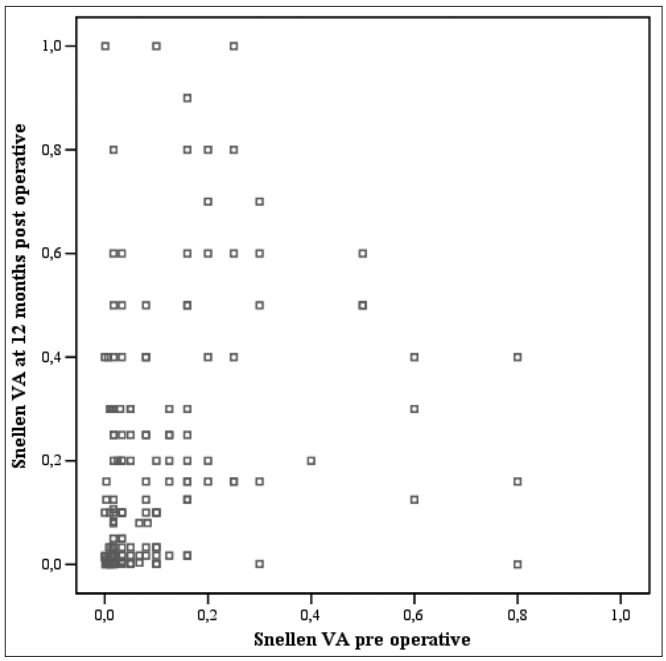

Fig. 2 - *Snellen visual acuity preoperatively versus visual acuity at 12 months follow-up.*

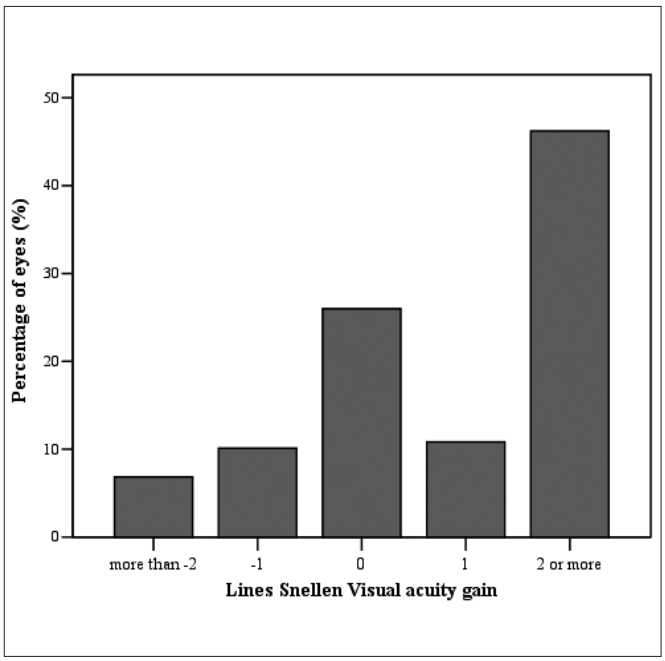

Fig. 3 - *Visual acuity improvement noted in number of Snellen lines. Improvement of at least two lines (n=128), improvement of less than two lines (n= 30), equal visual acuity (n=72), deterioration less than two lines (n=28), deterioration of at least two lines (n=19).*

TABLE II - SNELLEN VISUAL ACUITY (VA) PRE- AND POSTOPERATIVELY FOR THE WHOLE GROUP OF EYES OF <0.1 AND VA OF 0.1 OR MORE, INCLUDING EYES WITH A DETACHED RETINA

	Total eyes measured, n=287	Snellen VA <0.1, n (%)	Snellen VA ≥0.1, n (%)	Mean Snellen VA (SD)	p value univariate, by Wilcoxon signed rank test
Preoperative	285	186 (65)	99 (35)	0.040±0.73	
Postoperative					
3 mo	262	133 (51)	129 (49)	0.05±0.85	0.022
6 mo	199	97 (49)	102 (51)	0.05±0.94	NS
12 mo	158	65 (41)	93 (59)	0.06±0.95	0.005

NS = Not significant

the preoperative VA (p=0.022 and p=0.005, respectively) (Fig. 2, Tab. II).

An improvement of at least two Snellen lines was seen in 128/277 cases (45%) (Fig. 3). A deterioration of two Snellen lines or more was seen in 19/277 cases (7%). This deterioration was due to a detached retina in 15/18 eyes (83%), corneal decompensation in 6/19 eyes (32%), keratopathy in 9/19 eyes (47%), maculopathy in 4/19 eyes (21%), and a pale optic disc or optic atrophy in 5/19 eyes (26%). Other less frequent causes of vision loss were cataract and floaters. Although in 48 eyes we performed a cataract extraction after SOR, 4 out of the 48 eyes still had a deterioration of two Snellen lines or more. Of the above mentioned five patients with a pale optic disc, this may be caused by glaucoma in one patient because of high pre- and postoperative ocular pressures, but in the remaining four cases, we encountered no documented intraocular pressure rise during follow-up. Of the 158 eyes from which postoperative VA data were available at 12 months, almost 60% had a VA of

TABLE III - CLINICAL VARIABLES ASSOCIATED WITH WORSE VISUAL ACUITY AFTER SOR BY UNIVARIATE AND MULTIVARIATE ANALYSIS AT 12 MONTHS POSTOPERATIVELY

Factors	Total, n=158	Visual acuity ≥ 0.1, n=93 (58.9%), n (%)	Univariate analysis, p value	Multivariate analysis, p value
Preoperative				
Age, yr				
≤70	137	81 (59.1)	NS	NS
>70	21	12 (57.1)		
Gender				
Male	117	76 (65.0)	0.010	0.028
Female	41	17 (41.5)		
Visual acuity (Snellen) preoperative				
<0.1	101	46 (45.6)	<0.001	<0.001
≥0.1	57	47 (82.5)		
Rubeosis pre operative				
Yes	144	98 (68.1)	0.022	NS
No	14	4 (28.6)		
PDR pre SOR				
Yes	9	1 (11.1)	0.004	0.001
No	149	92 (61.7)		
Operations				
<3	95	68 (71.6)	<0.001	0.018
≥3	63	25 (39.7)		
Amount of SOR				
<3	156	91 (58.3)	0.028	NS
≥3	2	2 (100)		
SOR procedure				
Pars plana	96	59 (61.5)	NS	NS
Anterior segment	62	34 (54.8)		
Retinectomy				
Yes	68	27 (39.7)	<0.001	0.006
No	90	66 (73.3)		
Keratopathy				
Yes	50	20 (40.0)	0.002	NS
No	108	73 (67.6)		
Hypotony				
Yes	10	1 (10.0)	0.002	0.023
No	148	92 (62.2)		
Redetachment				
Yes	32	12 (37.5)	0.008	NS
No	126	81 (64.3)		

SOR = Silicone oil removal; NS = Not significant; PDR = Proliferative diabetic retinopathy

≥0.1 Snellen lines (Tab. II). We found that male sex (p=0.028), preoperative VA of <0.1 Snellen lines (p<0.001), PDR (p=0.001), the performance of three more operations (p=0.018), any size of retinectomy (p=0.006), and hypotony (p=0.023) were statistically significantly associated with a poorer visual outcome of <0.1 Snellen lines at 12 months by multivariate analysis (Tab. III).

Complications

Eighty-two out of 287 eyes (29%) developed keratopathy postoperatively; 33/82 eyes (40%) that developed a keratopathy postoperatively ultimately had a corneal decompensation. A history of three or more operations in one eye ($p<0.001$) and aphakia ($p=0.001$) were significantly associated with the development of keratopathy.

Preoperative ocular hypertension was found in 46/271 eyes (17%), while postoperative ocular hypertension was present in 23/270 eyes (8.5%) ($p<0.001$); 12 of these 23 eyes were new onset ocular hypertension after the SOR. The mean preoperative ocular pressure was 17.5 mm Hg (SD±8.4) and the mean postoperative ocular pressure was 13.4 mm Hg (SD±6.9). This difference was statistically significant ($p<0.001$). In 31/271 eyes (11%) we found a pale optic disc postoperatively, which was significantly associated with the presence of preoperative ocular hypertension ($p<0.001$) and the use of antiglaucoma drugs ($p<0.001$). Among the various diagnoses of PVR, PDR, trauma, and giant tear, there were no significant differences in the complication rate for the three above mentioned complications. In this study, patients without retinectomy had a significant association with postoperative ocular hypertension ($p=0.049$).

Hypotony was found in 17/287 eyes (6%). Three or more operations ($p=0.020$), a detached retina at the end of follow-up ($p=0.011$), and any retinectomy ($p=0.003$) performed were significantly associated with hypotony by univariate analysis. Only 2 of the 14 patients with preoperative hypotony also had postoperative hypotony. This was not statistically significant, either by univariate or by multivariate analysis. After multivariate analysis a detached retina at the end of the follow-up period ($p=0.013$) and any retinectomy ($p=0.012$) were associated with hypotony.

In 18 eyes (6%) silicone oil was removed because of elevated pressure and/or keratopathy. After the SOR, 6 eyes (33%) had a corneal decompensation and in 2 eyes (11%) the intraocular pressure remained high. In one of these two eyes a Baerveldt implantation was necessary to successfully lower intraocular pressure. One eye developed a phthisis bulbi and was enucleated.

DISCUSSION

In this study, 19% of the eyes had retinal redetachment after SOR. The current study made no prior selection in relation to SOR; this is in contrary to the Silicone Oil Study Report no. 6 (19), in which only 45% of all eyes had a SOR. The silicone-filled eyes that were chosen for SOR were the better eyes, with better VA, less preoperative operations, and less complications (19). Nowadays, we have better equipment and improved surgical techniques (21), like wide-angle viewing systems (22) and perfluorocarbon liquids (DK-line) (18, 23-25), which may improve the overall outcome of vitreoretinal surgery compared to 20 years earlier at the time of the Silicone Oil Study Reports (19).This is supported by the current study. The overall anatomic success in our study is higher (94%) than in the Silicone Oil Study Group no. 6: 81% (19). In addition, despite the fact that in the current series there was no preoperative selection and the postoperative follow-up period was longer (a mean follow-up of 21.2 months [SD±16.6] in the current study versus a total follow-up of 6 months in the in the Silicone Oil Study no. 6), the results for redetachment (19% in our study versus 20% in the Silicone Oil Study no. 6) and deterioration in VA (16.4% in our study versus 15.5% in the Silicone Oil Study Group no. 6) are comparable.

In the current study, in the eyes that had a redetachment, the detachment occurred after a mean period of 14.3 weeks (SD±20.6). Within the first 3 months after the SOR, 26 eyes (68%) had a retinal redetachment, which was mostly due to PVR. Within the first 6 months 87% had a redetachment. Of all eyes with a recurrent RRD, 8% developed the redetachment more than 1 year after the SOR. Our results are comparable to earlier studies, which reported a redetachment rate after SOR between 9% and 25% (6-8, 10-14, 26-28). The variation that is found between studies may be mainly due to differences in the duration of follow-up and preoperative selection of patients. Most authors report their results after a maximum follow-up of 6 months. In the current study, however, eyes were included with a longer follow-up period.

Independent predictors for recurrent RD were male sex, PDR, and the presence of rubeosis. Other studies, like that of Jiang et al (14), did not find preoperative rubeosis to be a risk factor associated with redetachment. This may be due to their smaller number of eyes (n=94) (14). Jonas et al (10) found that risk factors for redetachment (n=221) were a higher number of previously unsuccessful RD surgeries, the surgeon, VA before SOR, incomplete removal of the vitreous base, the absence of an encircling band in eyes with PVR, and the duration of the silicone oil tamponade (10). Additionally, in other studies the diag-

noses giant tear (n=92, n=58) (6, 14), age above 70 years (n=58) (6), and a retinectomy size of 180 or more degrees (n=58) (6) have been found to be significant risk factors of recurrent RD. In our larger study this could not be confirmed.

VA in our study improved significantly after SOR: 45% of the eyes had an improvement of 2 or more Snellen lines, and 36% had equal VA or had an improvement of one or more Snellen lines, which confirms earlier studies (6, 8, 10, 11, 27, 29). Delayed natural recovery of the retina and additional procedures performed at the time of SOR such as cataract extraction may contribute to a better postoperative visual outcome. One also has to keep in mind that since pre- and postoperative full refraction was not performed or documented in all cases, the apparent improvement in acuity may be partly due to different standards of acuity measurement.

Several independent predicators for a worse postoperative VA, defined in our study as a VA <0.1 at 12 months, were a worse preoperative VA, as was also found by Jiang et al (14). Additionally, the diagnosis PDR was also a significant risk factor, as was earlier described (30). In the current study we found that a history of three or more earlier operations before SOR, the performance of any retinectomy, and hypotony was also significantly associated with a poor visual outcome. In contrast, Eckardt et al (28) found that the size of the retinectomy had no association with visual outcome (28). Federman and Eagle (31), however, found a significant association between a large retinectomy of 360 degrees and a poorer visual outcome. It may be argued that a worse visual outcome in these eyes may be related to the advanced underlying pathology, which often makes it necessary to perform an extensive retinectomy.

In our study, 19 patients (7%) had an unexpected deterioration of two or more Snellen lines after SOR. Newsom et al (32) described seven patients with unexplained visual loss after SOR. Visual loss in these patients was not associated with redetachment, macular edema, or epiretinal membrane formation, and optical coherence tomography (OCT) showed a normal foveal anatomy (32). This unexplained sudden visual loss was also reported by others (33, 34). Retinotoxicity of the silicone oil may be one explanation (35). In addition, this toxicity of the silicone oil may also be the explanation for the optic atrophy, which was found in four eyes with a pale optic disc without documented intraocular pressure rise during follow-up. Damage of the photoreceptor outer segments as found recently by ultrahigh-resolution (UHR) OCT in eyes after anatomic successful repair is an other more probable explanation (36, 37). Also in eyes without macular detachment, such microstructural alterations have been discovered (36, 37).

Due to use of different criteria and definitions, it is difficult to compare studies. In this study we therefore used the same definitions for complications as the Silicone Study Report (19). Keratopathy was found in 29% of the cases. In other studies, this percentage varied between 4.5% and 100% (1, 2, 11, 27, 38). Differences may vary due to the use of different definitions. In the current study, a history of three or more operations and aphakia were identified as significant risk factors for the development of keratopathy, which confirms earlier studies (3, 13). We found significantly more keratopathy when eyes were aphakic and/or when eyes had undergone repeated surgery including anterior segment surgery, which confirms earlier studies (39-42). Both these variables are associated with (cumulative) damage to corneal endothelial cells (42), which may lead to the keratopathy.

Hypotony is a major complication, which is reported in many studies. In our series we found hypotony in 6% of cases, which is comparable to earlier studies (5, 11, 13, 26). Theories suggest that anterior PVR, traction, and detachment of the ciliary body may result in diminished aqueous humor production (4, 43-45). In an earlier smaller study we found a retinectomy size of 180 degrees or more to be a significant risk factor for hypotony (6). In the current larger series, we found, however, a significant association between hypotony and any size of the retinectomy. In contrast, Eckardt et al (28) found no relation between intraocular pressure and size of the retinectomy.

The incidences of glaucoma vary depending on the definitions used in the various studies. In our retrospective study there were incomplete data available on visual field defects and the presence of optic disc cupping. Therefore we used the definition of glaucoma as defined earlier in the Silicone Oil Study Group report no. 6 (19). This definition, however, does not distinguish between ocular hypertension and true glaucoma, because it does not take into account whether there were any related morphofunctional optic nerve changes. Using this definition, we found preoperative ocular hypertension in 17% and postoperative ocular hypertension in 8.5% of the eyes. In most other studies comparable or higher percentages were found (6, 8, 11, 26). The decrease in mean intraocular pressure after oil removal was significant in the current study. This

was also reported in earlier studies (6, 8, 11, 14). It may be concluded that removal of silicone oil may contribute to a better pressure control. The mechanisms underlying the development of chronic glaucoma after silicone oil tamponade are still not understood. The presence of oil droplets in the anterior chamber, especially when the oil is emulsified, with infiltration and obstruction of the trabecular meshwork, is probably the most important factor in causing ocular hypertension (46, 47). van Meurs et al (7) found significantly more glaucoma in cases with oil droplets in the anterior chamber angle. Duration of oil tamponade may play a crucial role in the process of emulsification (7). In our study, however, we could not find a significant association between ocular hypertension and the duration of oil tamponade or emulsification. Eyes in which no retinectomy was performed had a significant association with postoperative ocular hypertension. This may support the hypothesis that the performance of a retinectomy may be a valuable treatment for therapy resistant glaucoma (48), and may help to lower the incidence of postoperative ocular hypertension in silicone-filled eyes.

In conclusion, RD after SOR in the current series of eyes occurred in approximately 20%, which is comparable to the Silicone Oil Study Reports, published approximately 20 years ago. An important difference is that current results were obtained in an unselected series of eyes, whereas in the Silicone Oil Study Reports, less than 50% of eyes had SOR. In addition, compared to then, we were able to obtain a higher overall anatomic success percentage due to improved vitreoretinal surgical techniques. Independent risk factors for recurrent RD in the current series were male sex, rubeosis, and PDR. Risk factors for a worse visual outcome after SOR were found: male sex, a preoperative Snellen visual acuity <0.1, PDR, a total of three or more operations, any retinectomy performed, and hypotony.

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