Risk factors for failure after primary vitrectomy with no scleral buckling for rhegmatogenous retinal detachment

Fatores de risco para falha de tratamento após vitrectomia primária sem retinopexia com introflexão escleral

Mariano Iros[1], Juan Manuel Lopez[2], Nicolás Crim[3], Evangelina Espósito[4], Julio A. Urrets-Zavalía[4]

[1] Instituto de Microcirugía Ocular Córdoba, Córdoba, Argentina.
[2] Department of Ophthalmology, Centre Hospitalier Intercommunal de Créteil, Créteil, France.
[3] Department of Ophthalmology, Sanatorio del Salvador, Córdoba, Argentina.
[4] Department of Ophthalmology, Clínica Universitaria Reina Fabiola, Universidad Católica de Córdoba, Cordoba, Argentina.

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Corresponding author:
Juan Manuel López
Instituto de Microcirugía Ocular Córdoba
Wenceslao Paunero 2193
Córdoba 5000, Argentina
E-mail: drlopezjuan@gmail.com

Institution:
Instituto de Microcirugía Ocular Córdoba, Córdoba, Argentina.

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ABSTRACT

Objective: To assess pre-operative conditions that could influence primary anatomical success rate in a cohort of patients with rhegmatogenous retinal detachments (RRD) treated with primary vitrectomy and no scleral buckling.

Methods: A retrospective analysis was performed in a group of patients that underwent primary pars plana vitrectomy with gas tamponade and without scleral buckling for RRD between 2014 and 2019, with a minimum follow-up of 4 months.

Results: 305 eyes of 301 patients were included; 59.01% eyes were phakic, 39.01% were pseudophakic and 1.96% aphakic. 13.11% of patients had proliferative vitreoretinopathy grade B and 3.28% proliferative vitreoretinopathy grade C at the time of diagnosis while 83.61% had proliferative vitreoretinopathy grade 0 or A. 53.1% had superior breaks, 15.4% inferior breaks and 31.5% a combination of both. Primary success rate was obtained in 90.82% of eyes (95%CI 87.58-94.06). 9.18% of eyes (95%CI 5.94-12.42) re-detached. In 3.27% the cause of re-detachment was proliferative vitreoretinopathy, and in the remaining 5.90% because of a new or a missed break, the leakage of a previously treated break, or an area of shallow peripheral detachment with no detectable break. Of 181 phakic eyes, 10.49% re-detached, whereas in over 126 aphakic or pseudophakic eyes 7.75% re-detached (p=0.42). 16.39% eyes of the entire cohort had preoperative grade B or C proliferative vitreoretinopathy, whereas 32.14% of re-detached eyes had preoperative grade B or C proliferative vitreoretinopathy (95%CI 17.29-46.99; p=0.02). Th eyes that re-detached after the first surgery had a mean of 2.5 (95%CI 1.86-3.13) retinal tears, against a mean of 1.87 (95%CI 1.73-2.00) retinal tears of those that did not re-detach after the first surgery (p=0.02).

Conclusion: We found location of breaks and lens status to be independent factors not related to a lower single operation success rate, whereas the number or size of breaks and preoperative proliferative vitreoretinopathy stages B or C were independent factors related to a higher likelihood of re-detachment.

RESUMO

Objetivo: Avaliar condições pré-operatórias que poderiam influenciar a taxa de sucesso anatômico primário em uma coorte de pacientes com descolamento de retina regmatogênico tratada com vitrectomia primária e sem introflexão escleral.

Métodos: Foi realizada uma análise retrospectiva em um grupo de pacientes submetidos a vitrectomia primária pars plana com tamponamento gasoso e sem introflexão escleral por desprendimento de retina regmatogênico entre os anos 2014 e 2019, com monitoramento mínimo de 4 meses.

Resultados: Foram incluídos 305 olhos de 301 pacientes; 59,01% dos olhos eram fáquicos, 39,01% eram pseudofáquicos, e 1,96% era afáquico; 13,11% dos pacientes tinham vitreorretinopatia proliferativa grau B, e 3,28%, vitreorretinopatia proliferativa grau C no momento do diagnóstico, enquanto 83,61% tinham vitreorretinopatia proliferativa grau 0 ou A; 53,1% tinham rasgaduras superiores; 15,4%, rasgaduras inferiores e 31,5%, uma combinação de ambas. A taxa de sucesso primário foi obtida em 90,82% dos olhos (IC95% 87,58-94,06); 9,18% dos olhos (IC95% 5,94-12,42) se redestacaram. Em 3,27%, a causa do redescolamento foi vitreorretinopatia proliferativa e, nos 5,90% restantes, por causa de uma ruptura nova ou perdida, o vazamento de uma ruptura previamente tratada, ou uma área de descolamento periférico superficial sem ruptura detectável. Dos 181 olhos fáticos, 10,49% redestacaram-se, enquanto em mais de 126 olhos afáquicos ou pseudofáquicos 7,75% redestacaram-se (p=0,42); 16,39% dos olhos de toda a coorte tinham vitreorretinopatia proliferativa pré-operatória grau B ou C, enquanto 32,14% dos olhos redescolados tinham vitreorretinopatia proliferativa pré-operatória grau B ou C (IC95% 17,29-46,99) (p=0,02). Os olhos que se redescolaram após a primeira cirurgia tiveram média de 2,5 (IC95% 1,86-3,13) lágrimas retinianas, contra uma média de 1,87 (IC95% 1,73-2,00) lágrima retiniana daqueles que não se redestacaram após a primeira cirurgia. (p=0,02).

Conclusão: A localização das rasgaduras e o *status* da lente são fatores independentes não relacionados a uma menor taxa de sucesso da operação, enquanto o número ou o tamanho das rasgaduras e estágios vitreorretinopatia proliferativa pré-operatórios B ou C foram fatores independentes relacionados a uma maior probabilidade de redescolamento.

INTRODUCTION

Despite scleral buckling (SB) surgery as a primary procedure still remains a classic and well consolidated indication for some types of rhegmatogenous retinal detachments (RRDs), in recent years a general trend towards the use of vitrectomy as a primary surgical approach for most of the cases is seen among retinal surgeons around the world.[1-4]

A landmark paper published by Malbran et al. in 1977 established a differentiation between two distinct types of RRDs. Retinogenic detachments, in which the cause of the detachment is an atrophic retinal hole or a retinal dialysis, and vitreogenic detachments, in which the cause of the disease is a retinal break secondary to vitreous traction.[5]

Retinogenic detachments account for 5 to 15% of RRDs.[5,6] They usually develop in young people, in general are chronic, show slowly progressive detachments, vitreous is almost always attached and they show no tendency to proliferative vitreoretinopathy (PVR).[6] These particular cases should be treated with SB techniques and have a very high reattachment rate.[7] A vitrectomy procedure while dealing with this type of detachments may expose the eye to a higher rate of complications and failure.[8]

Vitreogenic RRDs, who account for 85 to 95% of detachments, are caused by vitreous traction. They are usually highly symptomatic, rapidly progressive and tend to lead to PVR development.[6]

Under certain conditions (PVR less than B, small retinal tears, clear vitreous, and no choroidal detachment or severe hypotony), vitreogenic detachments can also be treated primarily by a buckling procedure with excellent results. Nevertheless, primary vitrectomy is for most of vitreogenic cases the treatment of choice nowadays, specially where some degree of PVR or vitreous hemorrhage is present.[1]

Primary success rate (PSR) in retinal detachment treatment is defined as the proportion of cases successfully reattached with the first surgery. For RRDs treated by primary vitrectomy, PSR is reported to range between 80 and 90% in most published series.[9-12] Despite being vitrectomy the prevalent treatment approach for the disease, several issues are still under debate, such as the usefulness of adding an encircling band, especially in cases with inferior breaks, the type of tamponade that is better in each case, and the potential benefit of 360 degrees peripheral laser photocoagulation in the first surgery.

There is also a paucity of reports evaluating preoperative factors that could be related to a lower PSR after primary vitrectomy for RRD. The degree of preoperative PVR, the timing of surgery, the extension of detached retina, the location, size, and number of breaks, and lens status are some of the studied factors that can impact surgical success.[13-15]

The aim of our study was to assess pre-operative conditions that could influence primary anatomical success rate in a cohort of patients with RRD treated with primary vitrectomy and no SB.

METHODS

We retrospectively reviewed the medical records of patients who underwent primary pars plana vitrectomy with gas tamponade and without SB for RRD between 2014 and 2019. The exclusion criteria included retinogenic retinal detachments, previous vitreoretinal surgery, PVR of grade greater than C1, and less than 4 months of postoperative follow-up.

All the patients underwent a standard three port 23-gauge vitrectomy performed by the same surgeon. Vitrectomy was carried out using the Constellation Vitrectomy System (Alcon Laboratories, Fort Worth, Texas, United States) or the Associate Vitrectomy System (DORC, Zuid-Holland). Fundus visualization during vitrectomy was achieved using a BIOM system (Oculus, Germany). A complete vitrectomy with vitreous base shaving, with the aid of peripheral scleral depression, was performed in each case. Retina was reattached using perfluoro-n-octane (PFO) and all breaks were treated either with laser or cryotherapy, or both. A complete fluid air exchange was performed, and vitreous cavity was filled with a 20% mixture of sulfur hexafluoride gas (SF6). Sclerotomies were sutured only if leakage was observed after trocars removal. After the intervention, patients were positioned in a lateral or prone position, depending on the localization of the breaks. If breaks were located in the inferior quadrants (between 4 and 8-clock hours), prone position was maintained for the first three days, and then alternated with lateral decubitus.

The variables collected for each patient included age, gender, laterality, preoperative and postoperative best-corrected visual acuity, macular status, lens status, number of quadrants involved, location and number of breaks, size of breaks, and PVR status. The main outcome measure was the primary anatomic reattachment 4 months after surgery.

Student's t test, Mann-Whitney, Chi squared, or Fisher test were used in the statistical analysis. Chi squared and odds ratio were used to determine risk factor. InfoStat was the statistical software used. Statistical significance was considered when $p<0.05$.

The study was approved by the institutional review board of IMOC (Instituto de Microcirugía Ocular Córdoba) and conducted in accordance with the tenets of the Declaration of Helsinki. An informed consent was obtained from all patients participating in the study.

RESULTS

Outcomes

In over 305 operated patients, our PSR was 90.82% (95%CI 87.58-94.06) (277 eyes). 28 eyes (9.18%; 95%CI 5.94-12.42) re-detached in a mean time of 34.17 days (range of 15-120 days) after the initial surgery. In ten (3.27%), the cause of re-detachment was the development of PVR, and in the remaining 18 (5.90%), it was due to the appearance of a new or a missed break, the leakage of a previously treated one, or an area of shallow peripheral detachment with no detectable break. After the primary surgery, we accounted for a 3.24% of failure due to PVR development in the entire cohort (Table 1).

Primary success rate according to lens status

No statistically significant difference was observed between the rate of re-detachment among phakic and pseudophakic or aphakic patients. Over 181 phakic eyes, 19 (10.49%) re-detached, whereas over 126 aphakic or pseudophakic eyes 9 (7.75%) re-detached (p=0.42) (Table 1).

Primary success rate according to break location

Of 162 (53.11%) eyes that had breaks only in superior quadrants, 14 (8.64%) re-detached, whereas of 47 eyes (15.40%) that had breaks only in inferior quadrants, 4 (8.51%) re-detached.

Among 96 eyes (31.47%) that had breaks in both superior and inferior quadrants, 10 (10.41%%) re-detached. No statistically significant difference was observed between the rate of re-detachment between these 3 groups (p=0.86) (see Table 1).

Primary success rate according to pre-operative proliferative vitreoretinopathy stage

Over 255 eyes that presented PVR grades 0 or A at the time of diagnosis, 19 (7.45%) re-detached, whereas over 40 eyes that presented PVR B, 7 (17.5%) re-detached, and over 11 eyes with PVR C, 2 (18.18%) re-detached (p=0.07).

In the overall cohort of 305 eyes, 50 (16.39%) had preoperative PVR grade B or C, whereas in 28 eyes that re-detached after initial surgery, 9 (32.14%) (95%CI 17.29-46.99) had preoperative PVR grade B or C (p=0.02) (see Table 1).

Primary success rate according to number or extension of retinal breaks

95 eyes (31%) of the entire cohort had more than two breaks or one break bigger than 2 clock hours of size, whereas 12 eyes (42.8%) of the re-detached eyes had more than two breaks or one break bigger than 2 clock hours (p=0.02).

Eyes that re-detached after the first surgery had an average of 2.5 (95%CI 1.86-3.13) retinal tears, against a mean of 1.87 (95%CI1.73-2.00) retinal tears of those that did not re-detach after the first surgery (p=0.02) (see Table 1).

Table 1. Baseline characteristics

No. of patients	301
Eyes	305
Lens status	
Phakic	59.01 (180)
Pseudophakic	39.01 (119)
Aphakic	1.96 (6)
PVR status	
A	83.61 (255)
B	13.11 (40)
C	3.28 (10)
More than 2 breaks	31.14 (95)
Macula status	
Off	75.40 (230)
On	24.60 (75)
Breaks location	
Superior	53.1 (162)
Inferior	15.4 (47)
Superior and inferior	31.5 (96)
Pexia	
Laser	60.98 (186)
Cryotherapy	20.66 (63)
Both	18.36 (56)

*Results expressed as n or % (n). ** PVR: proliferative vitreoretinopathy.

DISCUSSION

Several preoperative factors have been considered to influence the outcome and prognosis in retinal detachment repair.[13-16] Re-detachment rate after primary vitrectomy for RRD may be variable according to several authors but it is estimated to be between 10 and 20% in most of the published series.[12,15,17-19]

Lens status could be a differential prognostic factor for failure according to Caiado et al., who found a much higher rate of re-detachment after primary vitrectomy for RRD in phakic compared to pseudophakic eyes.[20] In our series, we also found a slight tendency towards a worse PSR in the phakic compared to pseudophakic arm (10.5% versus 7.1%); however, it was not statistically significant

(p=0.42). These findings could be related to the fact that in pseudophakic or aphakic eyes, the intraoperative access to the peripheral retina under indentation is easier and safer, without the risk of injuring the lens, as could occur in phakic eyes. Likewise, vitreous base shaving may be more effective, and the visualization of tiny peripheral breaks may be easier, contributing to a lower re-detachment rate.

Another interesting issue that has been largely discussed is the failure rate according to break location and the possible benefit of adding an encircling band while performing primary vitrectomy, especially in detachments with inferior breaks. A meta-analysis by Totsuka et al.[21] concludes that the addition of an encircling band at the initial vitrectomy improves primary reattachment rate, whereas Goto et al.[22] found that the success of primary vitrectomy in cases with inferior breaks is lower compared with superior breaks. On the other hand, Walter et al.[23] in VIPER 2 study, concludes that the addition of an encircling band does not decrease the incidence of a second procedure in vitrectomy for pseudophakic RD. In the same line, Baumgarten et al.[24] and Ghoraba et al.[25] do not support any benefit from adding a circumferential buckle in retinal detachments with inferior breaks. Furthermore, the EVRS RD study also did not support any benefit from the addition of an encircling band in uncomplicated RDs treated by primary vitrectomy.[8] The aim of our study was to evaluate the results of primary vitrectomy without SB. Moreover, the addition of any kind of buckling was an exclusion criteria. Therefore, we cannot draw any conclusions about the possible effect of combined (vitrectomy plus buckling) procedures in final re-attachment rate.

Concerning preoperative location of breaks, we did not find any difference in PSR in patients with inferior compared to superior breaks, or combined superior and inferior breaks (8.51%, 8.58% and 10.3% respectively) (p=0.86). According to our results, in a population of medium complexity RRD's with PVR not superior to C1, the re-detachment rate after primary vitrectomy with no buckling was independent of break location.

Proliferative vitreoretinopathy development is considered to be the main cause of failure after successful retinal re-attachment surgery. It is estimated to complicate 5 to 10% of RD operated eyes.[26-28] In our cohort, post-operative PVR occurred in 3.24% of cases, showing a slightly lower proportion than several published series.[26-28] This might be due to the fact that our patients had not only a low proportion of preoperative B and C stages of PVR (16.23%), but also because the mean area of detached retina was not too large (2.3 quadrants in average). It is known that one of the factors that could influence re-detachment and PVR development is preoperative extension of the disease.

Preoperative PVR stage has also been found to be an independent factor related with a higher re-detachment rate.[15,29,30] In line with these previous reports, in our study, we found a lower single-surgery success rate in cases with a higher preoperative PVR stage. Eyes with preoperative PVR stages B or C were more likely to re-detach compared to those with stages 0 or A, and a much higher rate of preoperative stages B or C was observed among the 28 re-detached patients compared with the entire cohort (p=0.02).

Preoperative PVR status is an extremely important factor to consider while comparing different series of patients. In our overall results, PSR was achieved in 91% of the cases. This high PSR obtained might be possibly related with the high number of eyes with preoperative grade zero or A PVR (83.77%) that could help to increase the overall success rate of the primary surgery. Moreover, while analyzing patients with preoperative PVR grades B and C, the success rate with a single surgery dropped to 82%, showing the impact of this variable in the surgical result.

The number and characteristics of retinal breaks had also been considered important prognostic factors for re-detachment.[14,16,25,29,30] It is generally accepted that a high number of breaks, giant breaks, or posterior breaks, tend to have worse postoperative prognosis.[14] In fact, we also found a statistically significant relationship between number or size of breaks and PSR. Patients with more than two breaks or large tears were more prone to re-detach after the first surgery (p=0.02).

The lack of a control group and its retrospective nature are the main weaknesses of our study. Despite these limitations, the study has strengths, such as the high number of cases with quite similar pre-operative characteristics (most of the cases were medium complexity RRDs), and the fact that every patient was operated by the same surgeon with the same technique and at the same surgical setting.

CONCLUSION

In conclusion, retinal detachment is an extremely variable disease, and our success rate might depend on multiple preoperative conditions. Location of breaks and lens status were found to be independent factors not related to a lower single operation success rate, whereas the

number or size of breaks and preoperative proliferative vitreoretinopathy stages B or C were independent factors related to a higher likelihood of re-detachment.

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