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Original article

Myopic macular hole-associated retinal detachment with proliferative vitreoretinopathy

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ABSTRACT

Purpose: The objective of this study was to report the clinical characteristics and surgical results of patients suffering from retinal detachment, which was induced by a myopic macular hole and complicated by proliferative vitreoretinopathy, but without previous vitreoretinal surgery.
Methods: Interventional case series of 22 eyes in 20 patients with excessive myopia and macular hole-associated retinal detachment complicated with proliferative vitreoretinopathy were scrutinized retrospectively. All eyes had undergone par plana vitrectomy, including peeling of the epiretinal membrane, internal limiting membrane around the macular hole, and silicone oil or perfluoropropane (C_3F_8) retinal tamponade. An encircling buckle was also inserted in some of the eyes. Eyes with previous vitreoretinal surgery were excluded from this review.
Results: The average age of patients was 68.3 ± 7.17 years, average duration of symptoms prior to seeing an ophthalmologist 8.36 ± 4.14 months, and average axial length 30.01 ± 1.81 mm. Nine of the 20 patients had bilateral retinal detachment. The average number of operations performed was 1.36 ± 0.58. The success rate of the initial surgery was 63.3%, which improved to 90.9% in subsequent procedures.
Conclusion: A macular hole with proliferative vitreoretinopathy is associated with retinal detachment for a long duration. Retinal reattachment and improved visual acuity could be achieved in most eyes after a surgical intervention.

1. Introduction

Rhegmatogenous retinal detachment induced by a macular hole is not a rare event in excessive myopic eyes with posterior staphyloma. The area of rhegmatogenous retinal detachment of the macular hole is often confined to the area of posterior pole in the early stage. Some patients may develop subtotal or total retinal detachment later. To our knowledge, macular hole-induced rhegmatogenous retinal detachment in myopic eyes complicated by proliferative vitreoretinopathy (PVR) has not been discussed previously. In this review, we report the clinical characteristics and surgical results of macular hole-associated retinal detachment complicated by PVR in excessive myopic eyes.

2. Materials and methods

2.1. Patients

A retrospective review of 22 eyes in 20 patients with myopic macular hole-associated retinal detachment and complicated by PVR of Stage C or higher severity was conducted between January 2002 and June 2005 in Changhua Christian Hospital. Written consent was obtained from each patient for the review.

2.2. Diagnosis

Macular hole-associated retinal detachment was confirmed by the direct viewing of staphyloma after reattachment of retina intraoperatively. The peripheral fundus was checked carefully in all patients. After careful peripheral indentation, only eyes without breaks other than macular holes were included. Patients with uveitis, diabetic retinopathy, eye trauma, and previous vitreoretinal surgery were excluded.

The authors have no conflicts of interest relevant to this article.

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2.3. Data

The best corrected pre- and postoperative Snellen visual acuity was recorded for all patients. Findings of the slit lamp biomicroscopy, indirect ophthalmoscopy including presence of staphyloma, stage of PVR, and extent of retinal detachment were recorded. Pre- and postoperative color fundus photographs were also taken. Patients were asked about the duration of their symptoms. The number and methods of operations were recorded.

2.4. Surgical methods

Pars plana vitrectomy, proliferative membrane peeling, and indocyanine green (ICG)-assisted peeling of the internal limiting membrane (ILM) were performed in all eyes. An encircling buckle was inserted in all but four eyes at the initial surgery. Silicone oil or C3F8 gas was used as a retinal tamponade. No laser procedure was performed around the macular hole. Silicon oil was removed 6 months after surgery if the retina was attached completely.

2.5. Follow-up

Indirect ophthalmoscopy, visual acuity, axial length, and ocular coherence tomography (Stratus OCT, Carl Zeiss Meditec Inc.; Dublin, California, USA) were performed during the follow-up period at our clinic for at least 8 months to observe the closure of the macular hole. The refractive status was not included in data analysis, because most of the eyes were pseudophakic and the refractive status could not represent the status of axial elongation.

3. Results

Patients' demographic data are listed in Table 1. The average age of the 20 patients (16 females and 4 males) was 68.3 ± 7.17 years. Seventeen of the 22 eyes had undergone a previous cataract operation with posterior chamber intraocular lens implantation. Duration of symptoms ranged from 4 months to 18 months (average: 8.36 ± 4.14 months). The average postoperative axial length was 30.01 ± 1.81 mm (range: 28.35–33.12 mm). PVR Stage C was noted in 19 eyes, and three eyes had Stage D PVR. Nine patients had bilateral retinal detachment and two of them (Cases 4 and 17) had macular hole-associated retinal detachment and PVR in both eyes at presentation. These two patients had both their eyes repaired at our institute. In another female patient (Case 7), the fellow eye displayed macular hole-related retinal detachment, which developed during the follow-up period and was confined to the posterior pole. However, she refused any treatment for the newly occurring retinal detachment as she felt that she still had better vision in that eye than in the treated one. The other six patients had developed fellow eye retinal detachment years earlier. They either had a previous surgical failure in the fellow eyes or just left them untreated. Posterior staphyloma was present in all 22 eyes, of which 16 were noted with chorioretinal atrophic patches underlying a macular hole. Fifteen eyes had total retinal detachment and seven others had subtotal detachment, all of which had retinal detachment involving greater than 3 quadrants. Initial visual acuity ranged from light perception to counting finger.

Pars plana vitrectomy, membrane peeling, and ILM peeling were performed in all eyes, and an encircling buckle was inserted in 18 of the 22 eyes during the initial surgery. Two of the four eyes without

Table 1
Demographic data of the patients.

No/sex/age/eye	Duration of symptom (mo)	Stage of PVR	Extent of RD	Preop VA	Final VA	Number of OP	SO tamponade	Duration of follow-up (mo)	Macular hole closure	Bil RD	C-R atrophic at fovea	Axial length (mm)	Final retinal status
1.F/69/OD	5	C	Total	HM	0.05	1	Y	14	N	N	Y	31.21	A
2.F/64/OD	12	D	Total	HM	0.03	1	Y	35	N	Y	Y	29.83	A
3.F/71/OS	4	C	Subtotal	HM	0.01	1	N	27	N	N	Y	30.62	A
4.F/58/OD	12	D	Total	LP	0.01	2	Y	46	N	Y	N	30.23	A
F/58/OS	5	C	Total	LP	0.2	2	Y	23	N		N	29.77	A
5.F/61/OS	8	C	Total	HM	0.03	1	Y	44	N	Y	N	30.56	
6.M/69/OS	10	C	Subtotal	HM	0.04	1	Y	42	Y	Y	N	32.08	A
7/F/74/OD	6	C	Total	HM	0.01	1	Y	23	N	Y	Y	33.12	A
8.F/64/OD	7	C	Subtotal	HM	0.01	2	Y	18	N	Y	Y	29.57	A
9/F/65/OS	4	C	Total	HM	0.01	1	Y	45	N	N	Y	30.98	A
10/F/58/OS	6	C	Total	HM	0.1	2	Y	31	N	Y	N	28.73	A
11.M/69/OD	8	C	Total	LP	0.02	1	Y	21	N	Y	Y	29.99	A
12.F/89/OS	18	C	Total	LP	HM	1	Y	8	N	N	Y	NA	Partial A
13.M/69/OD	4	C	Total	HM	0.04	3	Y	19	N	N	N	28.12	A
14.F/71/OS	4	C	Subtotal	CF	CF	2	Y	9	N	N	Y	NA	Partially A
15.F/59/OD	5	C	Subtotal	CF	0.2	1	N	15	Y	N	N	28.35	A
16.F/71/OS	12	C	Total	HM	0.01	1	Y	12	N	N	Y	30.21	A
17.F/77/OD	18	D	Total	HM	0.01	1	Y	19	N	Y	Y	29.67	A
F/77/OS	6	C	Subtotal	CF	0.1	1	N	21	N	N	N	29.18	A
18.M/72/OS	8	C	Subtotal	CF	0.1	1	N	17	N	N	N	28.51	A
19.F/67/OD	9	C	Total	CF	0.1	1	Y	14	Y	N	Y	30.12	A
20.F/69/OD	10	C	Total	HM	0.1	1	N	22	N	N	N	29.38	A

A = attached; Bil = bilateral; CF = counting finger; C-R = chorio-retinal; HM = hand motion; N = no; OP = operation; PVR = proliferative vitreoretinopathy; RD = retinal detachment, SO = silicone oil; Y = yes; OD = right eye; OS = left eye.

buckling insertion had failed the primary surgery and required a secondary one in which an encircling buckle was inserted. Silicone oil was used as a retinal tamponade in 16 eyes in the primary surgery, of which seven eyes had surgical failure and needed repeated surgeries. A gas (C3F8) was used as a retinal tamponade in six eyes in the primary surgery. One of these six eyes with C_3F_8 tamponades had surgical failure in the initial attempt and had silicone oil tamponades applied in the second successful operation. Lensectomy was performed in all the five phakic eyes. Retina was totally attached in 14 eyes (63.3%) after the first operation, in five eyes after the second operation, and in only one eye after the third operation. For the other two eyes, one patient refused any further surgery after the first failure, but his retina was attached partially with a silicone oil tamponade. The other patient had macula attached and partial retinal detachment after the second operation with a silicone oil tamponade. All patients in whom retina was reattached completely had silicone oil removed 6–8 months after surgery without recurrent retinal detachment. The final success rate for total retina reattachment was 90.9%. Considering all the 22 eyes, the average number of operations performed for correcting retinal detachment was 1.36 ± 0.58, and all but one eye (Case 14) had improved final visual acuity, which ranged from hand motion to 0.2. Macular holes were closed in three eyes all of which had received silicone oil tamponade application. Duration of macular hole closure ranged from 3 months to 6 months after surgery. All patients were followed up at our clinic for at least 8 months.

4. Case report

4.1. Case 7

A 74-year-old female patient came to our clinic with a complaint that her left eye had progressively lost visual acuity over 6 months. Upon examination, her both eyes were found to be pseudophakic. Total retinal detachment, macular holes, and Stage C PVR were noted in the left eye (Fig. 1). Visual acuity was 0.1 in the right eye, but only hand motion in the left eye. She received pars plana vitrectomy, peeling of PVR membranes, ICG-assisted ILM peeling around the macular hole, encircling buckle insertion, air fluid exchange, and silicone oil tamponade application. No laser was applied around the macular hole. The retina of her eye was well attached postoperatively (Fig. 2). Unfortunately, macular hole-associated shallow posterior retinal detachment was noted 2 months later at the follow-up clinic (Fig. 3). She refused any further surgery on her left eye because she thought that she still had a good vision in the right eye. She had the silicone oil removed 6 months after surgery. Eight months after the retinal detachment surgery, her visual acuities were 0.01 and 0.05 in the left and right eyes, respectively.

5. Discussion

Macular hole-associated retinal detachment in excessive myopic patients complicated with PVR has never been discussed previously. This is probably due to the common notion that there is little chance of developing PVR in this group of patients. In this series, we report 22 eyes in 20 patients with such cases. All these patients had not undergone previous vitreoretinal surgery and had a long duration of symptoms (4–18 months) prior to visiting our clinic. The actual duration of retinal detachment in our group might have been longer than what were reported by the patients themselves, because some of them did not perceive visual loss at the initial stage of retinal detachment, which was usually confined only to the posterior pole for several months prior to subtotal or total retinal

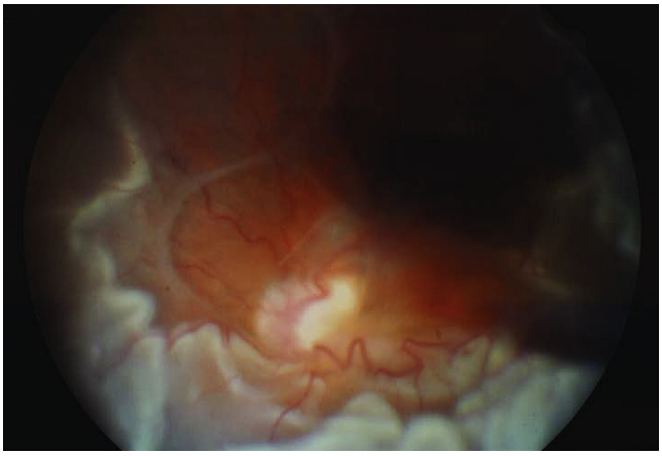

Fig. 1. Total retinal detachment with fixed retinal fold at three quadrants around the optic disc noted in the left eye at the initial visit.

detachment. According to previous reports,[1,2] long duration and large extent of retinal detachment are risk factors for PVR.

The mean duration of retinal detachment in the report of Tseng et al[1] was 58.4 days, which is much shorter than that in our series (8.36 ± 4.14 months). One reason why it may take a longer time for macular hole-associated retinal detachment to develop PVR is as follows. It is well known that PVR is a reparative response of ocular tissue for retinal breaks and retinal detachment. Larger breaks and more bullous retinal detachment tend to have a higher chance of developing PVR.[1–3] Because macular hole-associated retinal detachment is often shallow and localized to the posterior pole at the initial stage, PVR would more likely develop at a later stage of macular hole-induced retinal detachment when the extent of retinal detachment is large.

Sixteen of the 22 eyes were noted with chorioretinal degeneration at the macular hole area, which might be the reason why those patients delayed in seeking help. Because they had experienced poor visual acuity prior to the onset of retinal detachment, they were less likely to pay attention to any further deterioration in the already visually compromised eyes, thus missing the chance of early treatment. We noted a high incidence of bilateral retinal detachment in nine patients of this series. An increased chance of macular hole-associated retinal detachment in the fellow eye was also noted, as reported by Tsujikawa et al.[4] A follow-up examination seems essential for patients with macular hole-associated

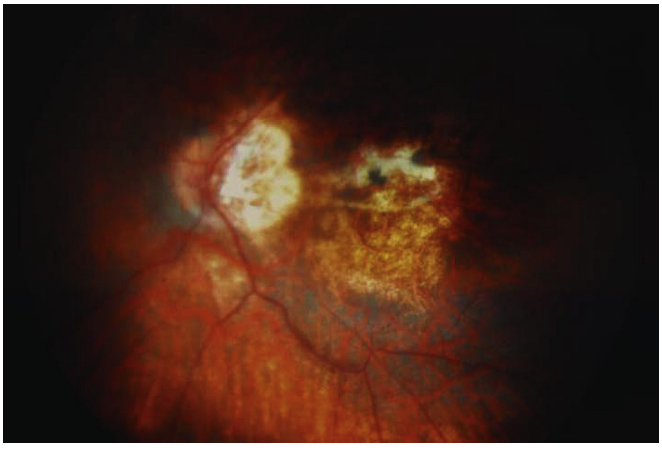

Fig. 2. Retina is well attached after surgery. An atrophic patch at macula is noted.

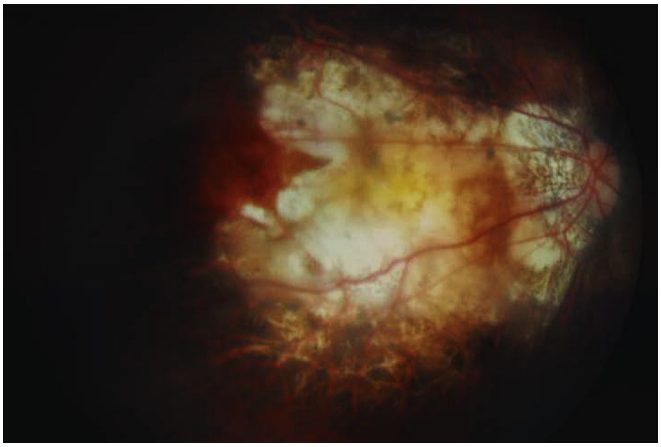

Fig. 3. Macular hole-associated retinal detachment at the posterior pole is noted in the right eye 2 months after surgery.

retinal detachment in excessive myopic eyes for an early intervention of retinal detachment in fellow eyes.

In spite of the fact that no laser was applied around the macular hole and a low percentage of macular hole closure, we still could achieve good surgical results in terms of a high final retinal reattachment rate and lower requirement for repeated operation comparable to or better than most of other PVR-related reports.[5–7] Subsequent corneal edema, elevated intraocular pressure, and hypotony were not present in any case during the follow-up. Two reasons might account for this. First, the severity of PVR in macular hole-associated retinal detachment was low. In none of our patients, anterior PVR was noted in the primary surgery. Only two of the 22 eyes had Stage D PVR, whereas most eyes in our series had Stage C PVR. Second, all patients in this series had a long duration of retinal detachment, and PVR probably had reached a mature stage prior to operation; thus, they were less likely to have a recurrence of membrane formation after surgery. Comparing with other reports of macular hole-associated retinal detachment without specific indication of PVR, the anatomical success rate after initial surgery in our series is worse than the results of those cases undergoing vitrectomy and ILM peeling, but comparable to or better than other cases having vitrectomy but without ILM peeling.[8–11] ILM removal improves the success rate of macular hole-associated retinal detachment greatly. In eyes without ILM peeling, the primary success rate of macular hole-associated retinal detachment is only around 50%; whereas after ILM peeling, it improves to more than 70–90 %. In our series, ILM peeling not only helped remove all residual cortex and epiretinal membrane around the macular hole, but also helped prevent recurrent epiretinal membrane from developing PVR and reduce the chance of recurrent retinal detachment. In this series, ILM peeling was performed in all eyes during the primary surgery. Some surgeons may have concerns that ICG solution would go into the subretinal space during the staining procedures. Fortunately, all cases had long-standing retinal detachment with viscous subretinal fluid, which prevented the ICG solution from entering into the subretinal space. For cases that failed the primary surgery, anterior PVR was the major cause of failure and recurrent epiretinal membrane was also absent.

An encircling buckle is often utilized by most retinal surgeons in most cases of PVR resulting from breaks other than macular holes. In our series, although an absence of anterior PVR was noted in all patients at presentation, we still placed an encircling buckle in most of our patients during the primary surgery. In the four patients without a buckle placement in the primary surgery, two eyes had recurrent retinal detachment resulting from subsequent inferior anterior PVR and reopening of the macular hole. An encircling buckle was inserted during the reoperation. Because we did not perform the laser procedure around the macular hole, an encircling buckle seemed necessary in our series as it might help lessen the chance of traction from subsequent anterior PVR.

Two reports have claimed that silicon oil, instead of a long-acting gas tamponade, may provide a better chance of retinal reattachment in macular hole-associated retinal detachment.[9,12] In these two cases series, ILM peeling was not used in their surgical methods. However, in our series, eyes receiving gas tamponades enjoyed a better primary success rate, which might indicate that after ILM peeling, silicon oil offers no advantage over the long-acting gas in reattaching retina in macular-associated retinal detachment with PVR. By contrast, all the three eyes with macular hole closure had silicone oil tamponades. Silicone oil instead of gas may be more beneficial in macular hole closure, because it provides a longer tamponade duration than air and thus a higher closure rate.

According to previous reports, macular holes were generally closed in more than 90% of cases with myopic macular holes without retinal detachment.[10] For macular hole-associated retinal detachment, closure rate usually ranges from 10% to 44% in the retina reattachment group.[11,13,14] In our series, we noted a low closure rate (13.6%) and a longer closure time (3 months and 5 months). Preoperative proliferative changes and residual traction probably play a major role in the low closure rate and slow closing process. In addition, most of our cases had chronic macular hole-associated retinal detachment, which might have also contributed to the low closure rate, as noted in previous reports of chronic idiopathic macular holes.[15]

We did not measure preoperative axial length because all our eyes had a macula-off retinal detachment preoperatively. The average postoperative axial length was 30.01 $\pm$ 1.81 mm in our series, which is longer than those described in most of the previous reports.[8–10] This may be partially attributed to the fact that most of our patients had an encircling buckle inserted, making the axial length longer than the preoperative one.

PVR may develop in myopic macular hole-associated retinal detachment without previous vitreoretinal surgery. Long-duration total or subtotal retinal detachment was observed in most patients in this series. Surgical success and visual improvement can be achieved in most patients with a timely diagnosis and proper treatment.

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