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열공망막박리로 섬모체평면부 유리체절제술 수술을 받은 환자들의 입원 치료 필요성

Necessity of Inpatient Treatment for Patients Undergoing Pars Plana Vitrectomy for Rhegmatogenous Retinal Detachment

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Purpose: The effectiveness of inpatient versus outpatient treatment with vitrectomy for rhegmatogenous retinal detachment (RRD) remains unclear. The present study aimed to compare RRD outcomes following 25-gauge minimally invasive vitrectomy surgery between patients treated at an ambulatory surgery center (ASC) and those treated at an inpatient facility.

Methods: We retrospectively analyzed the medical records of 86 patients (86 eyes) with RRD who underwent standard three-port 25-gauge pars plana vitrectomy between January 2017 and June 2019. The following outcomes were investigated: postoperative visual acuity (VA), postoperative intraocular pressure, postoperative vitreous hemorrhage, postoperative endophthalmitis, improvement in final vision relative to baseline, and final anatomical success rate.

Results: The ASC and inpatient groups included 45 and 41 patients, respectively. The two groups exhibited no significant differences in VA at 6 months postoperatively ($p = 0.26$) or final anatomical success rates (86.7% and 95.1% [$p = 0.27$], respectively). Nine patients were diagnosed with inferior RRD. There were no significant differences in postoperative VA ($p = 0.80$) or final anatomical success rates ($p = 0.44$) between the ASC and inpatient groups, including patients with inferior retinal breaks.

Conclusions: ASC treatment can achieve surgical outcomes comparable to those of hospitalization and may be more convenient for patients with RRD.

Keywords: Ambulatory surgical procedures; Hospitalization; Retinal detachment; Vitrectomy

Introduction

Postoperative hospitalization was once considered essential for systemic management (including control of pain, nausea, vomiting, and diabetes) following vitreoretinal surgery, as proposed by Isernhagen et al. [1]; however, the need for hos-

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pitalization depends not only on surgery-related variables, but also on the presence and severity of underlying diseases [2]. Recent developments in vitreous retinal surgery and local anesthesia technology have decreased surgery time for various retinal procedures and reduced the need for preoperative examinations and general anesthesia, thus reducing the frequency of hospitalization. Surgery is becoming increasingly simple and fast, and many patients can be treated at an ambulatory surgery center (ASC) and discharged immediately after surgery without inpatient treatment. Previous reports have suggested that vitreoretinal surgery is possible in such settings because an ophthalmological examination before discharge on the same day can prevent intraocular pressure (IOP) abnormalities. Furthermore, as patients who are required to travel long distances from home may be examined on the second postoperative day because the necessity of immediate postoperative examination declined with the increased predictability of result with ambulatory surgery, support for the utility of surgery at an ASC continues to grow [3,4].

Retinal detachment is a major cause of blindness; the retinal pigment epithelial layer is separated from the neural retinal layer and falls off. The most common cause is rhegmatogenous retinal detachment (RRD). Goto et al. [5] highlighted inferior retinal breaks as the only cause of re-release after vitrectomy. Although reports suggest that the surgical success rate of primary vitrectomy is similar to that for inferior retinal breaks, treatment remains difficult [5]. While 25-gauge pars plana vitrectomy (PPV) is effective for general RRD [6]. It may be necessary to perform the surgery simultaneously with intraocular gas filling (sulfur hexafluoride [SF_6], perfluorinated propane [C_3F_8]) or intraocular silicone oil infusion with scleral buckling. Appropriate postoperative posture is required to induce re-attachment of the retina. In addition, maintaining a specific posture, such as the prone position after surgery, may be difficult, and many patients fail to comply [7,8].

ASC treatment may achieve comparable surgical results to those of hospitalization and may be more convenient for patients with RRD. Therefore, in the present study, we aimed to compare RRD outcomes following 25-gauge minimal invasive vitrectomy surgery (MIVS) between patients managed with either ASC or inpatient treatment, including patients with inferior RRD.

Materials and Methods

Data for 86 patients diagnosed with RRD at our hospital who underwent standard three-port 25-gauge vitrectomy between January 2017 and June 2019 were retrospectively analyzed. Cases involving concurrent scleral buckling during primary surgery were excluded. All surgeries were performed by four retinal specialists. This study complied with the Declaration of Helsinki and was approved by the Institutional Review Board of Keimyung University Dongsan Hospital (approval number: 2020-07-035). The need for informed consent was waived because of the retrospective nature of the study.

Standard three-port 25-gauge vitrectomies were performed in all patients using the CONSTELLATION® Vision System (Alcon, Fort Worth, TX, USA). During surgery, a triamcinolone injection (Dongkwang Pharmacy, Seoul, Korea) was used to induce peripheral and posterior vitreous detachments. Peripherally, the tractional vitreous was removed using a sclera depressor, if necessary. Intraretinal incisions using an endodiathermy and subretinal drainage using liquid-gas exchange were performed with intraocular laser coagulation. Subsequently, room air, SF_6, C_3F_8, or silicone oil was used for intraocular filling at the discretion of the operator. In cases of cataract surgery accompanying vitrectomy, phacoemulsification and lens implantation were performed before vitrectomy. An eye-patch was applied overnight after the operation for both groups. A postoperative topical drop of antibiotics (Moxifloxacin 0.5%; Vigamox, Novartis Pharma AG, Basel, Switzerland) and steroid (prednisolone acetate 1%; Predforte, Allergan, Dublin, Ireland) was prescribed four times daily for a month.

Age, sex, preoperative best-corrected visual acuity (BCVA; logarithm of the minimum angle of resolution [logMAR]), preoperative IOP, preoperative vitreous hemorrhage, presence of macular detachment, the extent of retinal detachment, location of retinal breaks, presence of proliferative vitreoretinopathy, and the period from symptom manifestation to surgery were investigated. The extent of retinal detachment and locations of retinal breaks were divided into four equal parts in the 12 o'clock direction. The superior (clockwise from the 10:30 to 1:30 direction), inferior (clockwise from the 4:30 to 7:30 direction), and remaining parts in the horizontal direction were divided into three different groups. If the location of the retinal breaks was not identified or invaded several quadrants (combined), the data were excluded

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from retinal break analysis.

Outpatient or inpatient treatment, anesthesia during surgery, concurrent cataract surgery, subretinal fluid drainage using retinal incisions, type of intraocular filling, and posture immediately after surgery were analyzed for all patients. Postoperative visual acuity (VA) and IOP, vitreous hemorrhage, endophthalmitis, final improvement in vision, and final anatomical success rate were also investigated. Postoperative posture was divided into prone, adjustable, and supine positions without a specific posture. During the 6-month follow-up period, cases where retinal re-attachment was well-maintained without additional reoperation, including gas injection, were classified as cases of primary anatomical success (defined as complete retinal attachment with an initial operation in the absence of tamponade agents). Among cases in which retinal re-attachment failed and re-treatment, including gas injection and secondary reoperation, was performed, those cases where retinal re-attachment was well-maintained 6 months after the first operation were classified as cases of final anatomical success (defined as complete retinal attachment with additional procedures or operations in the absence of tamponade agents). The period between the first operation and reoperation was investigated. Incomplete retinal re-attachment either at the 6-month follow-up or conditions in which silicone oil was injected into the vitreous cavity were considered as cases of final failure.

Group 1 was composed of patients who had been discharged from the ASC on the same day after surgery. Group 2 was composed of patients hospitalized before and after surgery who were subsequently observed in outpatient clinics. The average length of the hospital stay was analyzed (1 day for group 1). Patients with inferior RRD were divided into two groups for separate analysis based on the same criteria. Data for patients with retinal detachment due to inferior RRD and other types of RRD were also analyzed separately.

Statistical analyses were performed using IBM SPSS Statistics ver. 23.0.0 (IBM Co., Armonk, NY, USA). Student's *t*-test was used for normally distributed variables, while Pearson's chi-square test or Fisher's exact test was used for categorical variables, as appropriate. p-values < 0.05 were considered statistically significant.

Table 1. Baseline clinical characteristics of patients with rhegmatogenous retinal detachment who underwent pars plana vitrectomy

Characteristic	ASC group (n = 45)	Inpatient group (n = 41)	*p*-value
Average length of stay (days)	1	2.9 ± 0.9	< 0.001*
Age (years)	58 ± 12	57 ± 10	0.71*
Sex, male	27 (60.0)	23 (56.1)	0.71†
Preoperative BCVA (logMAR)	1.1 ± 1.1	0.9 ± 0.8	0.27*
Preoperative IOP (mmHg)	14 ± 3	13 ± 3	0.71*
Duration between symptoms and operation (days)	13 ± 20	24 ± 59	0.24*
Lens status			0.31†
Phakic	32 (71.1)	33 (80.5)	
Pseudophakic	13 (28.9)	8 (19.5)	
Vitreous hemorrhage	5 (11.1)	6 (14.6)	0.63†
Macular status			0.27†
On	24 (53.3)	17 (41.5)	
Off	21 (46.7)	24 (58.5)	
Location of breaks			0.94‡
Inferior	4 (13.8)	5 (15.2)	
Horizontal	11 (37.9)	11 (33.3)	
Superior	14 (48.3)	17 (51.5)	
PVR	1 (2.2)	0 (0.0)	1.00‡

Values are presented as mean ± standard deviation or number (%). ASC group is patients who underwent ambulatory surgery center-based vitrectomy and inpatient group is patients who underwent inpatient-based vitrectomy.
ASC = ambulatory surgery center; BCVA = best-corrected visual acuity; logMAR = logarithm of the minimum angle of resolution; IOP = intraocular pressure; PVR = proliferative vitreoretinopathy.
*Student *t*-tests; †Pearson's chi-square tests; ‡Fisher's exact tests.

Results

Of the 86 patients, group 1 was composed of 45 patients (45 eyes), while group 2 was composed of 41 patients (41 eyes). The mean length of stay in group 2 was 2.9 ± 0.9 days. The average ages in groups 1 and 2 were 58 ± 12 years and 57 ± 10 years, respectively. BCVA (logMAR) values were 1.1 ± 1.1 and 0.9 ± 0.8 in groups 1 and 2, respectively. The corresponding preoperative IOP values were 14 ± 3 mmHg and 13 ± 3 mmHg, respectively. The locations of the retinal tears in each group are shown in Table 1 even though 24 patients were excluded because the location of the retinal breaks could not be identified or because they had multiple retinal breaks. Other preoperative clinical patterns are also presented in Table 1.

Except for two patients (4.9%) who underwent general anesthesia in group 2, all patients received local anesthesia through retrobulbar injections. Six (13.3%) and three patients (7.3%) presented with cataracts and underwent accompanying surgery, and 15 (33.3%) and 12 patients (29.3%) under-

Table 2. Postoperative clinical characteristics of patients with rhegmatogenous retinal detachment who underwent pars plana vitrectomy

Characteristic	ASC group (n = 45)	Inpatient group (n = 41)	*p*-value
Anesthesia			0.22*
General	0 (0.0)	2 (4.9)	
Local	45 (100.0)	39 (95.1)	
Combination with phaco surgery	6 (13.3)	3 (7.3)	0.49*
Internal drainage procedure	15 (33.3)	12 (29.3)	0.69*
Tamponade			0.28*
Air	12 (26.7)	12 (29.3)	
SF_6	23 (51.1)	17 (41.5)	
C_3F_8	7 (15.5)	4 (9.8)	
Silicone oil	3 (6.7)	8 (19.5)	
Posture after vitrectomy			0.34*
Prone	13 (56.5)	17 (41.5)	
Adjustable	9 (39.1)	23 (56.1)	
Supine	1 (4.4)	1 (2.4)	
Glaucoma medication use within 6 months	17 (37.8)	11 (26.8)	0.28*
Vitreous hemorrhage after vitrectomy	1 (2.2)	1 (2.4)	1.00*
Endophthalmitis after vitrectomy	0	0	1.00*
Anatomical success after 6 months			
Primary anatomical success	38 (84.4)	36 (87.8)	0.47*
Final anatomical success	39 (86.7)	39 (95.1)	0.27*
Failure	6 (13.3)	2 (4.9)	0.27*
Mean secondary treatment interval (days)	21 ± 21	18 ± 19	0.77†
Postoperative BCVA (logMAR)			
1 month	0.5 ± 0.5	0.6 ± 0.4	0.62†
3 months	0.4 ± 0.4	0.5 ± 0.7	0.41†
6 months	0.4 ± 0.4	0.3 ± 0.3	0.26†
Vision improvement at 6 months	-0.6 ± 1.0	-0.6 ± 0.8	0.99†
Postoperative IOP (mmHg)			
POD 1	18 ± 11	15 ± 7	0.18†
1 month	16 ± 5	15 ± 3	0.57†
6 months	14 ± 3	15 ± 4	0.15†

Values are presented as mean ± standard deviation or number (%). ASC group is patients who underwent ambulatory surgery center-based vitrectomy and inpatient group is patients who underwent inpatient-based vitrectomy.
ASC = ambulatory surgery center; BCVA = best-corrected visual acuity; logMAR = logarithm of the minimum angle of resolution; IOP = intraocular pressure; POD = postoperative day.
*Pearson's chi-square tests; †Student *t*-tests.

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went subretinal drainage through a retinal incision in groups 1 and 2, respectively. The types of filling materials and positions after vitrectomy are shown in Table 2. We were unable to obtain postoperative posture information for 22 patients.

Postoperative BCVA and IOP values are presented in Table 2. One patient (2.2%) in group 1 and one patient (2.4%) in group 2 presented with vitreous hemorrhage. No patients presented with intraocular endophthalmitis. Improvements in final vision (logMAR) compared with preoperative VA were -0.6 ± 1.0 and -0.6 ± 0.8 in groups 1 and 2, respectively. Primary anatomical success rates were 84.4% and 87.8% (p = 0.47), and final anatomical success rates were 86.7% and 95.1% (p = 0.27) in groups 1 and 2, respectively (Table 2).

Of the 86 patients, nine were diagnosed with inferior RRD (four and five patients in groups 1 and 2, respectively). BCVA (logMAR) values were 1.2 ± 1.2 and 1.1 ± 0.6 in groups 1 and 2, respectively. The types of filling materials and positions after vitrectomies are shown in Table 3, excluding two patients for whom postoperative information could not be obtained. No significant between-group differences in VA were noted at 6 months postoperatively (0.7 ± 0.9 and 0.6 ± 0.5 for groups 1 and 2, respectively). Primary anatomical success rates were 75.0% and 60.0% (p = 1.00), and final anatomical success rates were 75.0% and 100.0% (p = 0.44) in groups 1 and 2, respectively (Table 3).

Of the 48 patients with RRD for whom the location of retinal breaks and postoperative posture could be confirmed, seven had inferior RRD, while 41 had other types of RRD. Positions after vitrectomy are shown in Table 4. Primary anatomical success rates were 57.1% and 90.2% in the inferior and non-inferior RRD groups, respectively (p = 0.05). The final anatomical success rates were 100% and 95.1% (p = 1.00), respectively (Table 4).

Table 3. Clinical characteristics of nine eyes in nine patients with inferior rhegmatogenous retinal detachment with inferior tears

Characteristic	ASC group (n = 4)	Inpatient group (n = 5)	p-value
Preoperative BCVA (logMAR)	1.2 ± 1.2	1.1 ± 0.6	0.54†
Tamponade			1.00‡
Air	1 (25.0)	2 (40.0)	
SF_6	2 (50.0)	1 (20.0)	
C_3F_8	0 (0.0)	0 (0.0)	
Silicone oil	1 (25.0)	2 (40.0)	
Posture after vitrectomy*			1.00‡
Prone	0 (0.0)	2 (40.0)	
Adjustable	2 (50.0)	3 (60.0)	
Supine	0 (0.0)	0 (0.0)	
Anatomical success after 6 months			
Primary anatomic success	3 (75.0)	3 (60.0)	1.00‡
Final anatomic success	3 (75.0)	5 (100.0)	0.44‡
Failure	1 (25.0)	0 (0.0)	0.44‡
Mean secondary treatment interval (days)	37 ± 40	7 ± 6	0.40†
Postoperative BCVA (logMAR)			
1 month	0.6 ± 0.9	0.7 ± 0.4	0.81†
3 months	0.6 ± 0.4	0.6 ± 0.4	0.90†
6 months	0.7 ± 0.9	0.6 ± 0.5	0.80†
Post-op IOP (mmHg)			
POD 1	17 ± 3	17 ± 8	0.89†
1 month	14 ± 3	14 ± 2	0.91†
6 months	12 ± 5	13 ± 2	0.95†

Values are presented as mean ± standard deviation or number (%). ASC group is patients who underwent ambulatory surgery center-based vitrectomy and inpatient group is patients who underwent inpatient-based vitrectomy.

ASC = ambulatory surgery center; BCVA = best-corrected visual acuity; logMAR = logarithm of the minimum angle of resolution; IOP = intraocular pressure; POD = postoperative day.

*We were unable to obtain posture information after surgery for two patients; †Mann-Whitney U-test; ‡Fisher's exact test.

Table 4. Comparison between eyes with inferior and non-inferior rhegmatogenous retinal detachment

Characteristic	Inferior RRD (n = 7)	Non-inferior RRD (n = 41)	*p*-value
Number of outpatient-based vitrectomies	2 (28.6)	13 (31.7)	1.00†
Preoperative BCVA (logMAR)	1.3 ± 0.9	1.0 ± 1.0	0.45‡
Tamponade			0.12†
Air	3 (42.8)	11 (26.8)	
SF_6	2 (28.6)	22 (53.7)	
C_3F_8	0 (0.0)	6 (14.6)	
Silicone oil	2 (28.6)	2 (4.9)	
Posture after vitrectomy*			0.22†
Prone	2 (28.6)	24 (58.5)	
Adjustable	5 (71.4)	17 (41.5)	
Supine	0 (0.0)	0 (0.0)	
Anatomical success after 6 months			
Primary anatomic success	4 (57.1)	37 (90.2)	0.05†
Final anatomic success	7 (100.0)	39 (95.1)	1.00†
Failure	0 (0.0)	2 (4.9)	1.00†
Mean secondary treatment interval (days)	7 ± 5	23 ± 19	0.22‡
Postoperative BCVA (logMAR)			
1 month	0.8 ± 0.6	0.5 ± 0.4	0.07‡
6 months	0.4 ± 0.5	0.3 ± 0.3	0.39‡

Values are presented as mean ± standard deviation or number (%).

RRD = rhegmatogenous retinal detachment; BCVA = best-corrected visual acuity; logMAR = logarithm of the minimum angle of resolution.

*We were unable to obtain posture information after surgery for two patients; †Fisher's exact tests; ‡*t*-tests.

Discussion

We investigated differences in RRD outcomes following vitrectomy between patients managed in an ASC or with inpatient treatment. Our findings indicated that there were no significant differences in postoperative VA or final anatomical success rates between the ASC and inpatient groups, including patients with inferior retinal breaks.

Hospitalization is generally recommended for patients with RRD to maintain posture and confirm postoperative IOP due to the physical effects of intraocular filling on retinal breaks. Post-vitrectomy, the vitreous body is removed, and the eyeball is filled with air, gas, or silicone oil, which prevents influx and facilitates the absorption of the remaining subretinal fluid [9,10]. In a fully prone position, the filling material is brought into close contact with the breaks due to buoyancy, while surface tension promotes the removal of subretinal fluid from the breaks. Therefore, a prone position is required to prevent the influx of liquid into the retinal breaks to prevent further detachment [11]. However, continuously maintaining a prone position is difficult and painful for patients [12-16]. and some patients fear that surgical failure may occur if this posture is not adopted. However, a recent study demonstrated that patients with RRD could adopt a position lying on their side depending on the location of the breaks after vitrectomy with no differences in final surgical success rate between the side and prone postures [17,18]. Another study demonstrated that the supine position resulted in good outcomes depending on the location of the breaks, and the need for hospitalization to maintain a specific postoperative position is debatable [19,20]. As long as the amount of the injected gas is sufficient, the tear will be completely enveloped by gas that can be resealed with surface tension can reseal it [10]. A previous study that analyzed results according to the type of gas filling revealed that the effects were similar [21]. In addition, differences in success rates according to filling used during surgery did not significantly differ, similar to our observations.

Therefore, similarities between patients treated at an ASC and those hospitalized for treatment may be explained as follows: when the tamponade material, such as air, gas, or silicone oil is larger than a certain level such that it covers the

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flap, the tear flap is reattached by surface tension rather than buoyancy. Therefore, retinal re-attachment may occur even if the angle between the tamponade material and detached retina is not optimal [10]. For these reasons, even if the postoperative posture is not maintained for a short period of time after ASC, there seems to be no effect on the success rate of surgery.

In this study, no significant differences in immediate or long-term IOP were observed between patients who had undergone hospitalization postoperatively and those treated at an ASC. Furthermore, no significant differences in the use of IOP medications were observed 6 months postoperative. Therefore, hospitalization may not be essential for measuring and controlling IOP.

There are several advantages of undergoing vitrectomy at an ASC. First, the discomfort of the hospital stay is avoided, and the total expense during the treatment can be minimized from the patients' perspective. Patients often complain of substantial discomfort as there is only sufficient space on the bed to maintain a prone position, and in a multi-person room, the patient may have difficulty resting comfortably [17-20,22]. Second, given improvements in local anesthesia technology and the good general condition of ophthalmic patients, it is not necessary to control for nausea, vomiting, and changes in blood glucose caused by the gases used for general anesthesia or glucocorticoids used after vitrectomy [2]. Hospitalization is unlikely to be necessary after vitrectomy for adult RRD, except in patients with severe diabetes. Third, when guardians staying at the hospital with the patients are not available, the patient may want to return home because they might prefer not to be alone at the hospital [22].

Inferior RRD does not increase the necessity of re-operation [23-25]. Nevertheless, there have been reports of low anatomical success rates for inferior RRD [5]. In the current study, when comparing results among patients with inferior RRD, three of four patients treated at an ASC demonstrated primary anatomical success, and three of five patients treated at an inpatient hospital demonstrated primary anatomical success. No significant intergroup differences in success rates were noted (Table 3). When comparing patients with inferior RRD and other types of RRD within the entire cohort, the proportion of patients treated at an ASC or through hospitalization was similar. Primary and final anatomical success rates did not significantly differ between groups after re-procedure or re-operation (Table 4). In summary, no significant differences in success rates were noted among patients with inferior RRD who were treated at an ASC or through hospitalization. This indicates that hospitalization treatment for short-term follow-up of patients with inferior RRD may be unnecessary.

This study had several limitations including its non-randomized, observational design and multiple operators. Limitations included the exclusion of scleral buckling when accompanying primary surgery, difficulties in finding retinal breaks, the exclusion of patients with retinal breaks spanning multiple segments, and the lack of the postoperative position records in many ASC patients. Since these effects may have been particularly prevalent in patients with inferior RRD, selection bias may have occurred. Although the surgical results in patients with inferior RRD were comparable in both groups, the evidence was relatively weak since the number of the patients with inferior RRD was small.

In conclusion, this study analyzed the necessity of hospitalization for 25-gauge MIVS in patients with RRD. The anatomical success rates of surgery and postoperative complications were not significantly different between hospitalized and ASC patients. In particular, similar results were observed in patients with inferior RRD. Therefore, avoiding hospitalization may be indicated given that the outcomes are similar for patients treated at an ASC, which may be more convenient for patients.

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Conflicts of Interest

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

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