Characteristic analysis of intraocular hypertension in patients with high myopia after vitrectomy combined with silicone oil tamponade

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Article

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Abstract

**Aim:** To examine the characteristics and outcomes of intraocular hypertension in patients with high myopia following vitrectomy combined with silicone oil tamponade, while also analyzing the correlated risk factors.

**Methods:** In this retrospective study, a total of 98 patients (98 eyes) diagnosed with high myopia rhegmatogenous retinal detachment (RRD) who received their initial pars plana vitrectomy (PPV) procedure combined with silicone oil tamponade at Hebei Eye Hospital between October 2020 and November 2022 were included. In all cases, all the affected eyes received 25G standard three-channel PPV through the flat part of the ciliary body, and the retina of the affected eyes was back in place after surgery. The basic information of the patient, such as gender, eye type, diopter, and extent of net detachment were duly documented after surgery. Following the surgical procedure, a series of standard assessments were conducted, including routine visual acuity examination, anterior segment examination using a slit-lamp indirect ophthalmoscopy, and fundus examination using slit lamp indirect ophthalmoscopy. The measurement of intraocular pressure (IOP) was performed on a daily basis for a duration of one week following the surgical procedure. After that, outpatient follow-up appointments were scheduled on a monthly basis to assess IOP and conduct fundus examination using slit lamp indirect ophthalmoscopy. A minimum follow-up period of 6 months was conducted for all patients subsequent to their surgical procedures. Initially, a univariate analysis was performed to examine relevant factors, followed by a multivariate Logistic regression analysis to assess variables that had statistical significance.

**Results:** Within the cohort of 98 patients diagnosed with high myopia and experiencing retinal detachment, there were 52 male and 46 female with the average age of (42.02±14.733) years. A total of 59 eyes (60.20%) experienced elevated IOP subsequent to PPV. 52 patients, comprising 53.06% of the participants, were seen that the administration of IOP lowering drugs resulted in the normalization of IOP. Conversely, a subset of 7 patients, accounting for 7.14% of the cohort, exhibited an inability to effectively manage IOP levels with therapeutic intervention. Among them, 5 underwent anti-glaucoma surgery (5.12%), and 2 patients (2.04%) declined the recommended surgical procedure, resulting in the persistence of elevated IOP. Patients were shown to have the highest likelihood of developing intraocular hypertension on the first, seventh, and fifth day following PPV, with corresponding probabilities of 11.00%, 11.00%, and 10.00% respectively. The results of the univariate analysis indicated significant differences in gender, IOP of the retinal detachment eye compared to the contralateral eye, and the difference in preoperative IOP between both eyes being ≥5 mmHg (P < 0.05). No statistically significant differences were seen in terms of age, diopter, range of retinal detachment, period of retinal detachment, eye type, and whether cataract phacoemulsification was combined (P < 0.05). Binary Logistic regression analysis showed that male and preoperative binocular pressure difference ≥5mmHg were independent risk factors for early intraocular hypertension after vitrectomy, and the OR values were 2.724 and 2.52, respectively (P < 0.05). There was significant difference between the occurrence time of intraocular hypertension and the occurrence of persistent intraocular hypertension. The majority of patients who experienced intraocular
hypertension within one day following surgery exhibited a temporary condition, but patients who developed intraocular hypertension between six to eight days after surgery were found to have a higher likelihood of developing permanent intraocular hypertension.

**Conclusions:** High myopia patients diagnosed with RRD who underwent PPV together with silicone oil tamponade exhibited a higher propensity for intraocular hypertension. The majority of patients could be effectively managed with the administration of IOP lowering drugs. Males and preoperative binocular pressure difference $\geq 5$mmHg were risk factors for intraocular hypertension. Long-term monitoring of IOP is necessary for postoperative patients in order to prevent visual damage resulting from both short-term post-operative elevation of IOP and persistent intraocular hypertension.

1. **Introduction**

High or pathological myopia is commonly characterized by a spherical equivalent of less than $-6.00$ diopters (D) or an axial length exceeding 26.5 millimeters. This condition affects around 27–33% of individuals diagnosed with myopia and is widely acknowledged as a significant contributor to impaired vision and legal blindness $^{[1]}$. According to estimates, the global population of individuals with high myopia is anticipated to reach 938 million by the year 2050, resulting in significant economic and societal implications $^{[2]}$. Rheogenic retinal detachment (RRD) is one of the most serious complications of high myopia, and the primary therapeutic approach employed for its management is vitrectomy $^{[3]}$. Transient or persistent intraocular hypertension is a frequently observed clinical complication following surgery. In cases where intraocular hypertension becomes severe, it can result in central retinal artery obstruction and optic nipple ischemia, leading to surgical failure, visual impairment, and potentially even complete loss of vision $^{[6,5,4]}$. It has been reported that the incidence of intraocular hypertension after vitrectomy ranges from approximately 24–56.5%, while patients with high myopia may experience intraocular hypertension at a significantly higher rate, with recorded incidences reaching up to 60.00% $^{[9,8,7]}$. However, its pathogenesis and influencing factors remain uncertain, and there is a lack of information regarding the characteristics and outcomes of intraocular pressure (IOP) fluctuations among patients with high myopia following vitrectomy. This study collected a total of 98 patients diagnosed with high myopia who had vitrectomy combined with silicone oil tamponade at Hebei Eye Hospital. The study documented the variations in IOP, medication usage, and ultimate clinical outcomes among patients with intraocular hypertension, while also doing an analysis of the associated risk factors. This study also aimed to offer insights and empirical evidence to facilitate the investigation of the occurrence, development, prognosis, and pathogenic mechanism of postoperative intraocular hypertension in patients of this nature.

2. **Materials and Methods**

2.1 **General Information**
The present study constituted a retrospective case study and all patients signed written informed consent.

The present study collected clinical data from high myopia patients diagnosed with RRD who received PPV treatment at Hebei Eye Hospital between October 2020 and November 2022. Exclusion criteria encompassed patients with intraocular hypertension preoperatively, a family history of glaucoma, previous vitrectomy or other ocular surgery, ocular trauma history, or severe complications during or after the procedure. Among the 98 high myopia patients diagnosed with RRD, 52 were male and 46 were female, with an age range of 7 to 70 years and an average age of (42.02 ± 14.7338) years.

### 2.2 Surgical procedure

All patients were treated with 25G PPV by the same senior head physician. Following the completion of regular disinfection, draping, and the administration of general anesthesia, a standard oriented scleral incision was executed at a distance of 3mm posterior to the corneal limbus. Subsequently, a three-channel closed 25G vitrectomy procedure was conducted. During the surgical procedure, the peripheral vitrectomy was excised under maximum pressure conditions. The remaining vitrectomy cortex was thoroughly excised using triamcinolone staining, and the preretinal proliferative membrane was entirely excised using 25G microscissors. Following the gas-liquid exchange, a standard silicone oil was utilized for tamponade. After silicone oil injection, IOP was effectively regulated at Tn through the utilization of digital tonometry testing. Dexamethasone was injected under the conjunctival ball, while the eyes were coated with tobramycin and dexamethasone eye ointment inside the conjunctival sac. The patient was instructed to maintain a prone position. In accordance with the requirements of the condition, it was recommended that patients presenting with lens opacity undergo cataract phacoemulsification combined with vitrectomy. Furthermore, whenever feasible, the implantation of an intraocular lens should be performed in stage I.

Tobramycin and dexamethasone sodium phosphate eye drops, praprofen eye drops, and tobramycin and dexamethasone eye ointment were applied within 24 hours following the surgical procedure. Routine postoperative assessments were conducted, including examinations of visual acuity, the anterior segment examination using a slit-lamp indirect ophthalmoscopy, and fundus examination using slit lamp indirect ophthalmoscopy. The measurement of IOP was conducted on a daily basis during the first week following the surgical procedure. In addition, IOP was recorded at the 14th and 28th day post-surgery. After that, a monthly outpatient follow-up was conducted to assess IOP and examine fundus examination using slit lamp indirect ophthalmoscopy.

### 2.3 Management of postoperative intraocular hypertension

In general, the classification of intraocular hypertension is based on the timing of its occurrence following surgery. Specifically, intraocular hypertension that appears within one week after surgery is referred to as the early stage, while the middle stage encompass the period within two months. Subsequently, intraocular hypertension that develops after two months is categorized as the late stage. Persistent intraocular hypertension is defined as the duration of intraocular hypertension lasting for a period of 30
days or longer. Before and after the surgical procedure, all patients received a series of routine eye examinations, including slit-lamp indirect ophthalmoscopy examination and ophthalmoscope assessments, among others. The noncontact tonometer was utilized to assess IOP both preoperatively and postoperatively on a daily basis throughout the patient's hospital stay, which lasted approximately one week, and to measure IOP at follow-up visits over a period of six months. Starting from the initial dressing assessment 12 to 24 hours after surgery, post-operative intraocular hypertension was diagnosed when the IOP recorded at any time exceeded 25mmHg (1mm Hg = 0.133kPa). The changes of IOP in the affected eye and the occurrence of post-operative intraocular hypertension were observed[10,7]. In the case of patients diagnosed with intraocular hypertension, a localized drug treatment was administered, while intravenous infusion of mannitol was employed when needed. In cases where patients did not exhibit a positive response to drug treatments, repeated anterior chamber punctures were conducted, and if the IOP remained unmanageable, the option of undergoing anti-glaucoma surgery was considered. Indications for the removal of silicone oil included the tamponade of silicone oil over three months, as well as the successful achievement of retinal reattachment.

2.4 Statistical analysis

The statistical analysis was performed using the SPSS21.0 statistical software. The Chi-square test was employed to perform a univariate analysis on the pertinent parameters pertaining to categorical data. The independent sample T test was employed for quantitative data that conformed to the normal distribution, whereas the independent sample Mann Whitney test was utilized for data that did not adhere to the normal distribution. A P value of < 0.05 was considered statistically significant.

3. Results

3.1 Occurrence of postoperative intraocular hypertension

Among the 98 high myopic patients diagnosed with RRD, 52 were male and 46 were female, with an age range of 7 to 70 years and an average age of 42.02 ± 14.733 years. The average diopter was found to be -10.643 ± 4.076 D, while the average preoperative IOP of the eyes affected by retinal detachments was measured to be 13.98 ± 4.021 mmHg. The average duration for the occurrence of intraocular hypertension after surgery was found to be 4.288 ± 2.229 days, as indicated in Table 1. Following PPV, a total of 59 patients (60.20%) exhibited intraocular hypertension, while 39 patients (39.80%) demonstrated normal IOP levels. Out of the cohort of patients diagnosed with intraocular hypertension, a total of 52 patients were able to effectively manage their IOP levels to within the normal range by the utilization of IOP lowering drugs. Among them, a total of 31 patients were identified to be in the early stage of the condition. Specifically, 1 patient utilized a single IOP lowering drug, 2 patients were prescribed two types of such drugs, 15 patients were prescribed three such drugs, and 13 patients were prescribed four such drugs. Additionally, 12 patients were categorized as being in the middle stage, with 5 patients using two types of IOP lowering drugs, 3 patients using three types of such drugs, and 4 patients using four types of such drugs. Lastly, 7 patients were classified as being in the late stage, with 3 patients using three types
of IOP lowering drugs and 4 patients using four types of drugs. 5 patients who were not responsive to medical treatment underwent surgical treatment. 2 patients was found in the early postoperative period: IOP returned to normal after silicone oil removal surgery from the anterior chamber in 1 patient who had silicone oil enter the anterior chamber, and IOP returned to normal in 1 patient who underwent scleral cyclodialysis coagulation surgery. 3 patients were in the late postoperative period: 2 patients had normal IOP after glaucoma surgery and 1 patient experienced a reduction to normal IOP six months after silicone oil removal surgery. 2 patients declined to undergo surgery due to their lack of discomfort and instead opted to continue using IOP lowering medications for an extended period. Despite this, both patients remained to experience intraocular hypertension (2.04%). Patients were shown to have the highest likelihood of developing IOP on the first, seventh, and fifth day following PPV, with 11.00%, 11.00%, and 10.00%, respectively.

3.2 Persistent intraocular hypertension after surgery

Among 59 patients with intraocular hypertension, 43 patients had transient intraocular hypertension whereas the remaining 16 patients presented with persistent intraocular hypertension. The examination of patients exhibiting persistent intraocular hypertension revealed that 93.75% (15 out of 16) of them had an IOP exceeding 10 mmHg before to undergoing surgery. Additionally, it was observed that 81.25% (13 out of 16) of the eyes affected by retinal detachments had a lower IOP prior to surgery compared to their contralateral eye. Among the patients who exhibited intraocular hypertension within the initial 24 hours following surgery, the intraocular hypertension was only lasted less than one week in 90.01% (10 out of 11) of patients whose average preoperative IOP was 10.4 mmHg. However, 60.00% (12 out of 20) of the patients who experienced intraocular hypertension 6–8 days after surgery developed persistent intraocular hypertension, with an average preoperative IOP of 14.32 mmHg. The occurrence time of IOP and whether persistent IOP occurred were shown to have a statistically significant relationship, as shown in Table 4. The majority of patients experiencing intraocular hypertension within one day following surgery exhibited a temporary condition, however patients who experienced intraocular hypertension between six to eight days after surgery were found to have a higher likelihood of developing persistent intraocular hypertension.

3.3 Statistical analysis of factors related to intraocular hypertension

The results of the chi-square test indicated that there was no statistically significant relationship between patients' age, diopter, range of retinal detachment, eye type, and whether or not combined with cataract phacoemulsification, and the occurrence of intraocular hypertension following silicone oil tamponade in patients with high myopia (P > 0.05). The statistical significance of various factors in the occurrence of intraocular hypertension after silicone oil tamponade in patients with high myopia was assessed. These factors included the gender of the patient, the comparison of IOP between the eye with retinal detachment and the contralateral eye, and the difference in IOP between both eyes prior to surgery (< 5 mmHg). The results indicated that these factors were statistically significant (P < 0.05), as shown in Table 2. The findings from the binary logistic regression analysis indicated that being male and having a difference in
IOP of at least 5 mmHg between both eyes prior to surgery were identified as independent risk factors for the early onset of intraocular hypertension following vitrectomy surgery, with OR values of 2.724 and 2.52, respectively. Table 3 demonstrates that the larger the OR value, the higher the risk.

4. Discussions

Patients with high myopia frequently experience either transient or persistent intraocular hypertension following vitrectomy. The occurrence rate of this condition is approximately 60.00%, far surpassing that observed in patients without high myopia. However, the current study mainly focused on all patients with intraocular hypertension after vitrectomy. In existing literature, limited attention has been given to the comprehensive analysis of high myopia as an independent risk factor. As a result, there is a lack of detailed information regarding intraocular hypertension in patients with high myopia following vitrectomy, such as alterations in IOP, methods of treatment, outcomes, and factors influencing these outcomes. Therefore, this article will focus on patients with high myopia, providing a comprehensive description and analysis of its distinctive features.

Among patients who experienced intraocular hypertension following PPV, 88.14% (52 out of 59 patients) were able to achieve normalization of IOP by the administration of IOP-lowering drugs. The utilization of a combination of 3 or 4 IOP-lowering drugs had demonstrated efficacy in managing the development and advancement of early intraocular hypertension in 90.32% (28 out of 31 patients) of the patients. Additionally, in cases where drug therapy proved ineffective during the initial postoperative period, it was recommended that prompt implementation of scleral cyclodialysis coagulation or anterior chamber silicone oil removal surgery. This approach was advantageous in terms of controlling IOP progression and alleviating the discomfort and distress associated with intraocular hypertension in patients at the earliest possible stage. Relevant studies have demonstrated the efficacy of administering glucocorticoids, short-acting cycloplegic agents, and drugs that suppress the generation of atrial fluid following surgery as standard approaches to decrease IOP. In addition, systemic and local IOP drugs have been found to effectively manage IOP in a range of 30–78% \[7,11\]. In cases where patients with intraocular hypertension exhibited persistent and uncontrolled symptoms for a duration of two months, the possibility of silicone oil removal might be considered, provided that the repositioning of the retina was satisfactory. In cases where the removal of silicone oil was not feasible, laser treatment was advised as a preferred course of action. 2 patients (2.04%) exhibited a fluctuating IOP range of 21–30 mmHg. They did not report any discomfort and voluntarily ceased the use of IOP-lowering drugs. However, it was noteworthy that both patients experienced alterations in the optic disc and optic nerve of the affected eyes, as well as vision field defects. This group of patients highlighted the importance of doing extended postoperative monitoring following vitrectomy surgery in order to prevent visual impairment resulting from short-term IOP elevation and chronic intraocular hypertension. Patients were most likely to experience an increase in IOP on the first, seventh, and fifth day following PPV, which was believed to be associated with postoperative inflammation or stimulation response.
In the course of conducting statistical and analytical process of the data of 61 patients with intraocular hypertension, it was seen that 45 patients experienced transient episodes of this condition, whereas 16 patients exhibited persistent intraocular hypertension lasting for a duration exceeding 30 days. Continuous intraocular hypertension may cause optic disc ischemia, optic nerve atrophy, and then lead to vision loss, which seriously affects the prognosis of patients. Therefore, our study focused on the analysis of clinical data and the characteristics of IOP among patients exhibiting persistent intraocular hypertension. Among the cohort of patients who encountered intraocular hypertension within the initial 24 hours following surgery, 90.01% (10 out of 11 patients) experienced a duration of less than one week. Within the subgroup of patients who encountered IOP between 6–8 days post-surgery, 60.00% (12 out of 20 patients) acquired chronic intraocular hypertension. Patients with persistent intraocular hypertension had an IOP > 10 mmHg before surgery in 93.75% (15/16) of the patients. In addition, among the eyes affected by retinal detachments, 81.25% (13 out of 16) exhibited a lower IOP prior to surgery compared to their contralateral eyes. Therefore, we analyzed the relationship between the disparity in preoperative IOP and the timing as well as the duration of intraocular hypertension. It was found that the occurrence time of intraocular hypertension had a statistically significant association with its persistence. Most patients with intraocular hypertension 1 day after surgery were transient, and those with intraocular hypertension 6–8 days after surgery were more likely to develop persistent intraocular hypertension. Based on the experiment data, it looked like that patients with lower preoperative IOP had a great possibility of experiencing transient intraocular hypertension. However, patients with retinal detachments and normal preoperative IOP had a higher likelihood of developing persistent intraocular hypertension. There was no statistical significance observed between these two groups. We deduced that the transient nature of intraocular hypertension, which occurs on the first day after surgery, can be linked to the autoregulatory function of the aqueous humor. In these patients, the preoperative average IOP was low. However, after the surgical restoration of anatomical features, such as the retina, there was an increase in the creation of aqueous humor feedback. When patients administered IOP-lowering drugs, the autoregulatory mechanism of aqueous humor progressively restored to a state of homeostasis, resulting in a return of IOP to its normal level and reducing the likelihood of subsequent elevation. When considering the reasons why intraocular hypertension occurred 6–8 days after surgery was more likely to persist, the following factors should be taken into account: 1) Accumulation of inflammatory response, With advancements in vitrectomy technology, surgical trauma has been reduced, resulting in a greater possibility of minor inflammatory reactions accumulating. These reactions can be caused by factors such as the stimulation of the ciliary body filled with silicone oil and mechanical stimulation during surgery. 2) Oxygen stress in trabecular reticulum Kentaro et al. [12] also found this delayed increase in IOP, suggesting that the occurrence of intraocular hypertension may be related to the elevation of oxygen partial pressure following PPV surgery. This increase in oxygen stress within the trabecular reticulum hindered the drainage of aqueous humor. 3) Self-healing of ciliary detachment During the initial phase after PPV surgery, a range of 12.12–77.3% of patients experienced mild ciliary detachment [13], which made the IOP appear normal in the early stage, but increased after the ciliary detachment healed itself.
The literature study on variables associated with intraocular hypertension following vitrectomy revealed inconsistent reporting of gender. For instance, Jabbour et al. found no substantial disparity in gender among patients with intraocular hypertension and normal IOP following surgery\(^{[14]}\), while Song Minmin et al. argued that males were a risk factor for elevated IOP after vitrectomy. In the correlation analysis between gender and IOP, Japan and South Korea reported that male IOP was higher than that of female\(^{[16,15]}\). Experimental investigations had indicated that the disparity in IOP across genders may be associated with sex hormones. Before the age of 15, there was no notable difference between the two genders. However, in older people, there was a distinct reversal in the relationship between estrogen levels and IOP, with men and women exhibiting a crossover phenomenon. It supported the hypothesis that estrogen had an impact on the resistance of the outflow of aqueous humor, leading to a reduction in IOP\(^{[18,17,13]}\). The participants of this study were patients diagnosed with high myopia. Among the 92 eyes with high myopia, 53 eyes exhibited intraocular hypertension, resulting in an incidence rate of 57.60% (53 out of 92). There were 21 female with an incidence of 39.62% (21 out of 53) and 32 male with an incidence of 60.38% (32 out of 53). The chi-square test revealed a statistically significant difference ($x^2 = 4.319, P < 0.005$), suggesting that gender may influence the occurrence of intraocular hypertension after vitrectomy in patients with high myopia. However, there are few such studies at present, which still need to be further explored.

Our study revealed that those with lower preoperative IOP and a difference of $\geq 5$ mmHg between the IOP of both eyes were more susceptible to experiencing postoperative intraocular hypertension. We deduced that the cause might be a reduction in the production of aqueous humor and the diversion of aqueous humor through the foveal hole into the subretinal region. This resulted in a decrease in IOP before surgery due to absorption by the choriocapillary blood vessels. Several studies had indicated a correlation between the size of the time hole in the range of retinal detachment and the preoperative IOP value. This suggested that the preoperative IOP value could indirectly and thoroughly predict the severity of the disease. Following the procedure, the production of aqueous humor typically returned to normal, whereas the IOP was more prone to rise when the aberrant flow of aqueous humor was obstructed. However, further investigation was required to fully understand the particular mechanism behind this phenomenon.

According to previous research conducted by other researchers, the use of silicone oil tamponade during combined cataract surgery had been identified as a risk factor for experiencing intraocular hypertension after the operation\(^{[29,28,27,26,25,24,23,22,21,20,19,7,3]}\). However, the study demonstrated that there was no statistically significant correlation between the combination of cataract and phacoemulsification. We hypothesized that this lack of correlation may be attributed to the relatively younger age of patients with retinal detachment in cases of high myopia. The average age of patients with high myopia was found to be $41.69 \pm 14.788$ years, which differed from the general population statistics reported in prior literature. Just 33.67% (33 out of 98) of the patients included in this study had cataract phacoemulsification surgery. Ever since Cibis et al. initially utilized vitreous silicone oil tamponade in human eyes, silicone oil has become extensively employed for the treatment of various vitreoretinal diseases. The occurrence of elevated pressure within the eye after surgery, known as postoperative intraocular hypertension, was
frequently observed in patients who have undergone vitreous silicone oil tamponade, with a prevalence exceeding 40%. Silicone oil tamponade is widely recognized in literature as a distinct risk factor for postoperative intraocular hypertension following PPV. Ichhpujani et al. proposed several mechanisms to explain the occurrence of intraocular hypertension, such as pupil obstruction, inflammation or preexisting glaucoma onset basis, silicone oil migration to the anterior chamber, and silicone oil emulsification. This study selected patients with high myopia and RRD undergoing vitrectomy. During the data collection phase, it was observed that vitreous cavity silicone oil was utilized as a filling agent for all patients, which was considered to be associated with the prevalence of highly myopic holes primarily located in the lower and temporal regions. In addition, it was noted that only a small proportion of patients (12.24%, 12/98) exhibited holes located in the upper region, which was related to the large range of retinal detachment. Therefore, the present study is unable to definitively exclude the potential impact of silicone oil filling on intraocular pressure. It is postulated that silicone oil might exert a significant influence on the underlying mechanism of intraocular hypertension, which requires further investigation.

Scholars have consistently expressed concern and conducted ongoing research on the association between IOP and myopia. However, a definitive conclusion has yet to be reached on this matter. Han et al. reported that IOP was closely related to axial length and equivalent spherical lens \[30\]. Similarly, previous studies had shown that the proportion of adults with myopia suffering from open-angle glaucoma was significantly increased \[31\]. Several studies had indicated that the elongation of the ocular axis and the thinning of the sclera associated with the progression of myopia could potentially result in decreased ocular compliance and elevated IOP, consequently leading to an increase in IOP \[32\]. The findings of this study indicate that there was a 60.20% likelihood of developing intraocular hypertension following surgery in patients with high myopia. These results aligned with previous research, providing further evidence that high myopia is indeed an important factor affecting IOP after vitrectomy. However, additional investigations are necessary to elucidate the underlying reasons for the substantially higher incidence of intraocular hypertension in patients with high myopia compared to those without this condition.

In conclusion, additional investigation is required to better explore the risk factors associated with intraocular hypertension following vitrectomy in patients with high myopia. In order to prevent the development of postoperative intraocular hypertension in patients, it is imperative to conduct a thorough preoperative ophthalmic evaluation. Several factors, including preoperative intraocular pressure, the disparity between bilateral intraocular pressures, and the timing of postoperative intraocular hypertension, may potentially serve as predictors for postoperative high intraocular pressure. Following surgery, it is imperative to continuously monitor the fluctuations in IOP in patients in order to promptly identify and address any instances of elevated pressure within the eye. This is of utmost importance in preserving the visual function of patients. Meanwhile, additional investigation is required to understand the mechanism of postoperative intraocular hypertension in these patients.

**Abbreviations**
rhegmatogenous retinal detachment (RRD)

pars plana vitrectomy (PPV)

intraocular pressure (IOP)

**Declarations**

All methods were performed in accordance with the ethical standards as laid down in the Declaration of Helsinki and its later amendments or comparable ethical standards.

Written informed consent was obtained from all participants. Include a statement on ethics approval and consent.

*Ethics approval and consent to participate*

The study was approved by the review board of the Hebei Eye Hospital.

*Consent for publication*

Written informed consent was obtained from the patient and their parents for publication of this case report.

*Availability of data and materials*

The datasets used and/or analysed during the current study available from the corresponding author on reasonable request.

*Competing interests*

The authors declare no competing interests.

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*Authors' contributions*

Yifan Wang wrote the initial version of the work and contributed to the design research, data gathering, and analysis. Hong Chen led the development of the experimental design and actively contributed to the discussion and refinement of the initial draft. Yanhui Wang and Zhongyang Yan contributed to the development of the experimental design and assisted in revising the publication. Yixiang Wu, Pengfei Shi, Yalin Li and Wei Feng contributed to the selection of experimental methodologies and provided assistance in data analysis. Lu Lu, Yan Cao, Xintong Zhang and Yong Liu were involved in data gathering, processing, and analysis.
Lifei Wang revised and confirmed the final version. All authors read and approved the final manuscript.

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Authors' information

Yifan Wang is a postgraduate student at Hebei Medical University.

References


Tables
Table 1
General information of patients with high myopia

<table>
<thead>
<tr>
<th>Case Category</th>
<th>Cases (%)</th>
<th>Mean standard deviation</th>
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<tbody>
<tr>
<td>Male</td>
<td>52 (53.1)</td>
<td></td>
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<tr>
<td>Female</td>
<td>46 (46.9)</td>
<td></td>
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<tr>
<td>Ave. Age</td>
<td></td>
<td>(42.02 ± 14.733) y</td>
</tr>
<tr>
<td>Ave. diopter</td>
<td></td>
<td>(-10.643 ± 4.076) D</td>
</tr>
<tr>
<td>Mean IOP before retinal detachment</td>
<td></td>
<td>(13.98 ± 4.021) mmHg</td>
</tr>
<tr>
<td>Postoperative occurrence time of intraocular hypertension</td>
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<td>(4.288 ± 2.229) d</td>
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### Table 2
Univariate logistic regression analysis of different factors on postoperative intraocular hypertension

<table>
<thead>
<tr>
<th>Factors</th>
<th>Intraocular hypertension group</th>
<th>Normal intraocular pressure group</th>
<th>t/Z/X²</th>
<th>P</th>
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<tbody>
<tr>
<td>age (S, y)</td>
<td>41.39 ± 14.45</td>
<td>42.974 ± 15.291</td>
<td>-0.519</td>
<td>0.609</td>
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<tr>
<td>Gender (cases, %)</td>
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<td></td>
<td>5.544</td>
<td>0.019**</td>
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<tr>
<td>Male</td>
<td>37(62.7)</td>
<td>15(38.5)</td>
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<tr>
<td>Female</td>
<td>22(37.3)</td>
<td>24(61.5)</td>
<td></td>
<td></td>
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<tr>
<td>Preoperative binocular pressure difference (mmHg, %)</td>
<td></td>
<td></td>
<td>4.804</td>
<td>0.028**</td>
</tr>
<tr>
<td>≥ 5</td>
<td>21(35.6)</td>
<td>6(15.4)</td>
<td></td>
<td></td>
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<tr>
<td>&lt;5</td>
<td>38(64.4)</td>
<td>33(84.6)</td>
<td></td>
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<tr>
<td>Compare the IOP of retinal detachment eye with contralateral eye (case, %)</td>
<td></td>
<td></td>
<td>6.565</td>
<td>0.010**</td>
</tr>
<tr>
<td>Greater than or equal to</td>
<td>14(23.7)</td>
<td>19(48.7)</td>
<td></td>
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<tr>
<td>less than</td>
<td>45(76.3)</td>
<td>20(51.3)</td>
<td></td>
<td></td>
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<td>Diopter (case, %)</td>
<td></td>
<td></td>
<td>0.496</td>
<td>0.481</td>
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<td>High myopia</td>
<td>29(49.2)</td>
<td>22(56.4)</td>
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<td>Ultra-high myopia</td>
<td>30(50.8)</td>
<td>17(43.6)</td>
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<td>Combined with cataract phacoemulsification (Cases, %)</td>
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<td></td>
<td>2.852</td>
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<td>Yes</td>
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<td>No</td>
<td>43(72.9)</td>
<td>22(56.4)</td>
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</table>

### Table 3
Relationship between occurrence time and duration of intraocular hypertension

<table>
<thead>
<tr>
<th>Day of appearance of increased IOP (case, %)</th>
<th>Persistent intraocular hypertension group</th>
<th>Transient intraocular hypertension group</th>
<th>t/Z/X²</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6–8</td>
<td>11</td>
<td>10</td>
<td>2.852</td>
<td>0.091</td>
</tr>
</tbody>
</table>

**Note:** Fisher exact probability method was applied.
Table 4
Multivariate logistic regression analysis of different factors on postoperative intraocular hypertension

<table>
<thead>
<tr>
<th>Factor</th>
<th>β</th>
<th>SE</th>
<th>Wald</th>
<th>OR(95%CI)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>1.002</td>
<td>0.468</td>
<td>4.581</td>
<td>2.724(1.088, 6.82)</td>
<td>0.032**</td>
</tr>
<tr>
<td>Preoperative binocular pressure difference ≥ 5</td>
<td>0.924</td>
<td>0.558</td>
<td>2.74</td>
<td>2.52(0.844, 7.525)</td>
<td>0.098*</td>
</tr>
<tr>
<td>IOP of retinal detachment eye ≥ IOP of contralateral eye</td>
<td>-1.081</td>
<td>0.481</td>
<td>5.051</td>
<td>0.339(0.132, 0.871)</td>
<td>0.025**</td>
</tr>
<tr>
<td>Combined with cataract phacoemulsification</td>
<td>-0.591</td>
<td>0.482</td>
<td>1.502</td>
<td>0.554(0.215, 1.425)</td>
<td>0.220</td>
</tr>
</tbody>
</table>