Comparison of Pre- and Postoperative IOP in Triamcinolone-Assisted Vitrectomy Patients with and without Lens Surgery

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ABSTRACT

Introduction: This retrospective study evaluates the impact of triamcinolone-assisted vitrectomy on intraocular pressure (IOP) in patients undergoing vitreoretinal surgery, with particular focus on comparing outcomes in patients with and without lens surgery. **Methods:** Medical records of patients treated at R.D. Kandou Hospital from May 2019 to May 2024 were reviewed, and pre- and postoperative IOP values were analyzed. A total of 35 patients met the inclusion criteria. **Results:** The results show a significant reduction in IOP at all postoperative intervals, with mean differences of 11.12 mmHg at 1 day, 8.60 mmHg at 1 week, 13.23 mmHg at 1 month, and 16.91 mmHg at 3 months postoperatively. Analysis revealed no significant difference in IOP outcomes between phakic and pseudophakic patients. **Conclusion:** These findings indicate that triamcinolone-assisted vitrectomy effectively lowers IOP, regardless of lens status.

Keywords: Intraocular pressure, triamcinolone, vitrectomy, vitreoretinal surgery.

ABSTRAK

Pendahuluan: Penelitian retrospektif ini mengevaluasi dampak vitrektomi berbantu *triamcinolone* terhadap tekanan intraokular (TIO) pasien yang menjalani operasi vitreoretina, membandingkan hasil pada pasien dengan dan tanpa operasi lensa. **Metode:** Rekam medis pasien di RSUP RD. Kandou dari Mei 2019 hingga Mei 2024 ditinjau; nilai TIO sebelum dan sesudah operasi dianalisis. Sebanyak 35 pasien memenuhi kriteria inklusi. **Hasil:** Hasil penelitian menunjukkan penurunan TIO yang signifikan pada semua interval pasca-operasi, dengan perbedaan rata-rata sebesar 11,12 mmHg pada hari pertama, 8,60 mmHg pada minggu pertama, 13,23 mmHg pada bulan pertama, dan 16,91 mmHg pada bulan pasca-operasi. Tidak ada perbedaan signifikan TIO antara pasien dengan lensa phakik dan pseudophakik. **Simpulan:** Temuan ini menunjukkan bahwa vitrektomi berbantu *triamcinolone* efektif menurunkan TIO, terlepas dari status lensa. **Ade John Nursalim, Vera Sumual, Ardelia Emily Wulur. Perbandingan Tekanan Intraokular Pre- dan Postoperatif Vitrektomi Berbantu-*Triamcinolone* dengan dan tanpa Operasi Lensa.**

Kata Kunci: Tekanan intraokular, *triamcinolone*, vitrektomi, operasi vitreoretinal.

INTRODUCTION

Pars plana vitrectomy (PPV) is a widely performed surgical procedure for treating a range of vitreoretinal diseases, including retinal detachment, proliferative vitreoretinopathy, and diabetic retinopathy. The primary objective of vitrectomy is to remove the vitreous humor and associated membranes, which can obstruct the retinal surface, allowing for improved retinal reattachment and visual outcomes. However, due to the vitreous' transparency, the surgical process can be technically challenging, especially when attempting to visualize and safely remove the posterior hyaloid. To address this issue, triamcinolone acetonide (TA), a water-insoluble corticosteroid, has been introduced as a valuable surgical aid. By injecting TA into the vitreous cavity, surgeons can effectively stain the vitreous and posterior hyaloid, significantly improving intraoperative visibility.[1,2] This enhanced visualization facilitates the complete removal of vitreous membranes, reducing the risk of complications such as residual vitreous remnants or retinal tears.[2] The use of triamcinolone-assisted vitrectomy has gained widespread adoption in ophthalmic surgery, particularly for complex retinal diseases like proliferative diabetic retinopathy (PDR) and proliferative vitreoretinopathy (PVR).

Postoperative intraocular pressure (IOP) management is a critical aspect of vitrectomy outcomes, as elevated IOP can lead to complications such as optic nerve damage and glaucoma. Triamcinolone, while beneficial for enhancing vitreous visualization, has been associated with transient increases in IOP due to its corticosteroid properties. Studies have reported that intraocular triamcinolone injection can result in short-term IOP elevation

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in a subset of patients, particularly those with preexisting risk factors for glaucoma.[1,2] Therefore, careful monitoring of IOP in the immediate postoperative period and during follow-up is essential to prevent long-term complications. The long-term effects of triamcinolone on IOP, however, remain under investigation, with varying outcomes reported depending on the patient's baseline ocular condition and whether other surgical interventions, such as lens surgery, are involved.

The status of the lens during vitrectomy is another factor that can influence postoperative outcomes, including IOP fluctuations. In some cases, vitrectomy is performed in conjunction with cataract surgery, either because of preexisting lens opacities or to prevent future cataract development, which is a common complication after vitrectomy. Lens extraction during vitrectomy may affect the dynamics of aqueous humor flow and alter IOP regulation in the postoperative period.[1,2] There is a need to better understand how lens surgery interacts with triamcinolone-assisted vitrectomy in terms of IOP management. The current literature lacks comprehensive studies comparing IOP changes in patients with and without lens surgery following triamcinolone-assisted vitrectomy. This gap underscores the importance of investigating this relationship to improve clinical outcomes and tailor postoperative management strategies based on individual patient characteristics.

Triamcinolone was initially introduced in ophthalmology as an anti-inflammatory agent for retinal diseases such as age-related macular degeneration (AMD) and diabetic macular edema (DME).[3] Its role expanded significantly in the 2000s when it was found to enhance the visualization of the posterior vitreous during vitrectomy procedures. The ability to stain the transparent vitreous and posterior hyaloid membrane during surgery has enabled surgeons to perform more complete and safer removals, especially in cases of complex retinal detachments and proliferative vitreoretinopathy (PVR).[4] Despite its widespread use, there were initial concerns about the corticosteroid's potential side effects, including elevated intraocular pressure (IOP) and possible toxic effects on retinal cells.[5]

Postoperative IOP elevation remains one of the most significant concerns in vitrectomy patients, particularly when corticosteroids like triamcinolone are used. Elevated IOP can lead to optic nerve damage, which, if left unmanaged, may progress to glaucoma and result in permanent vision loss. The introduction of triamcinolone in vitrectomy raised concerns about steroid-induced IOP spikes, which have been documented in several studies. Sakamoto et al. observed that while triamcinolone greatly improves surgical outcomes, it can cause a temporary rise in IOP, especially in patients with a history of glaucoma.[6-9]

Although these increases are generally transient and manageable with medication, close monitoring is necessary. Studies have also pointed out that postoperative inflammation, which contributes to IOP elevation, can be reduced by triamcinolone, further complicating its role in IOP management.[7,10,11]

Another factor contributing to postoperative outcomes is the development of cataracts following vitrectomy, especially in older patients. Cataract formation is a well-documented complication of vitrectomy, particularly in cases involving triamcinolone use. Jonas et al. reported that a significant percentage of patients undergoing vitrectomy with intravitreal triamcinolone developed cataracts within a year after surgery.[12]

As a result, many surgeons opt to perform combined cataract extraction and vitrectomy in older patients or those already presenting with lens opacities. Cataract extraction can influence postoperative IOP by altering the dynamics of aqueous humor circulation and possibly reducing the eye's natural defense mechanisms against IOP fluctuations.[12,13]

This study aims to compare the pre- and postoperative IOP changes in patients undergoing triamcinolone-assisted vitrectomy, with a focus on the impact of lens surgery on IOP regulation. By analyzing IOP trends in patients with and without lens surgery, this study seeks to provide insights into the role of lens status in postoperative IOP management. The findings will contribute to improving surgical planning and follow-up care for patients undergoing vitrectomy, particularly those at risk of elevated IOP or glaucoma. The primary objective is to determine whether lens surgery significantly alters the IOP trajectory in the early and late postoperative periods following vitrectomy with triamcinolone. Understanding the interaction between vitrectomy, lens status, and IOP is essential to tailoring postoperative care plans that minimize complications and optimize visual recovery.

METHODS

This retrospective study reviewed medical records of patients who underwent vitreoretinal surgery with triamcinolone assistance at RD. Kandou Hospital, Manado, from May 2019 to May 2024. To reduce variability, all surgeries were performed by a single vitreoretinal surgeon.

The population included patients who underwent triamcinolone-assisted vitreoretinal surgery during the five years. Inclusion criteria required complete medical records with pre- and postoperative intraocular pressure (IOP) measurements. Patients with incomplete records or pre-existing conditions significantly affecting IOP, such as uncontrolled glaucoma, were excluded. Data collected included age, sex, diagnosis, surgical details, triamcinolone dosage, IOP measurements (preoperatively and at 1 day, 1 week, 1 month, and 3 months postoperatively), and any postoperative complications like cataract formation or endophthalmitis.

IOP was measured using Goldmann applanation tonometry, with a standardized protocol to ensure consistency. Measurements were conducted by trained ophthalmic personnel. If multiple readings were taken, the average was recorded. Data extraction followed a standardized form to ensure accuracy.

Descriptive statistics summarized demographic and clinical data. Paired t-tests compared pre- and postoperative IOP within groups, while independent t-tests or Mann-Whitney U tests compared groups (with or without lens surgery). Repeated measures ANOVA was used to assess IOP changes over time. A p-value of <0.05 was considered statistically significant.

Ethical approval was granted by the R. D. Kandou Hospital Ethics Committee. As this was a retrospective study, patient consent was not required, and all data were anonymized to ensure confidentiality.

RESULTS

A total of 35 patients met the inclusion criteria. **Table 1** summarizes the demographic, intraocular pressure (IOP) measurements, diagnosis, and lens status of patients who underwent triamcinolone-assisted vitrectomy. The mean age of the study population was 51.51 years, with a range from 24 to 73 years, indicating a diverse age group. The median age was 51 years, and the standard deviation of 14.89 suggests significant variability in age across patients.

Preoperative IOP values varied widely, with a mean of 30.29 mmHg and a standard deviation of 14.11. Preoperative IOP ranged from 7 mmHg to 54 mmHg, reflecting different baseline ocular conditions in the cohort. Following surgery, a steady decline in IOP was observed across all postoperative time points. One day after surgery, the mean IOP dropped to 19.17 mmHg, with minimal variability (standard deviation 2.83). By the first week, the mean IOP was 21.69 mmHg, and by the first month, it had further decreased to a mean of 17.06 mmHg. At the three-month follow-up, the mean IOP was 13.37 mmHg, with the largest standard deviation at this stage (3.56), suggesting more variability in long-term IOP outcomes among patients.

The distribution of diagnoses within the study cohort reflects a variety of retinal conditions requiring vitrectomy surgery. Tractional retinal degeneration was observed in 9 patients, vitreous hemorrhages in 8 patients, and rhegmatogenous retinal detachment in 7 patients. Additionally, 11 patients presented with less common conditions, including epiretinal membrane (2 patients), macular hole (2 patients), central or branch retinal vein occlusion (CRVO/BRVO; 2 patients), and vitreomacular traction (VMT; 1 patient), as depicted in **Table 1.**

Table 1. Demographic data.

Variable	Frequency	Percentage
Age (Mean ± SD)	51,51 ± 15,11	-
Diagnosis		
Vitreous hemorrhages	8	23%
Rhegmatogenous retinal detachment	7	20%
Tractional retinal degeneration	9	26%
Epiretinal membrane (ERM)	2	6%
Macular hole	2	6%
Central/branch retinal vein occlusion (CRVO/BRVO)	2	6%
Vitreomacular traction (VMT)	1	3%
Lens Status		
Phakic	13	37%
Pseudophakic	22	63%

Lens status was categorized into two groups: phakic (patients with natural lenses) and pseudophakic (patients with artificial lenses, typically after cataract surgery). In this study, the majority of patients (22 out of 35) were pseudophakic, while 13 patients had phakic lenses. This distribution is consistent with the fact that vitrectomy is often performed in older patients, who are more likely to have undergone cataract surgery. The inclusion of both phakic and pseudophakic patients allows for comparisons between these two groups in terms of postoperative outcomes, particularly about IOP changes.

Table 2 summarizes the comparisons of intraocular pressure (IOP) at various time points before and after triamcinolone-assisted vitrectomy. The analysis highlights both the immediate postoperative effects and the changes in IOP over time.

When comparing preoperative IOP with the postoperative values, a significant reduction in IOP is observed at each time point (1 day, 1 week, 1 month, and 3 months) following the surgery. The mean difference between

Table 2. Intraocular pressure (IOP) results.

Variable	Mean	Median	SD	Minimum	Maximum	Range	Frequency
IOP Pre-	30,29	30	14	7	54	46	35
IOP Post-1 Day	19,17	19	3	15	23	15	35
IOP Post-1 Week	21,69	22	3	15	27	27	35
IOP Post-1 Month	17,06	17	1	15	19	4	35
IOP Post-3 Months	13,37	12	4	8	21	13	35

Table 2. Intraocular pressure comparison over time.

Comparison	Mean Difference	Standard Deviation	t-value	p-value	Significance (p<0.05)
IOP Pre- vs. IOP Post-1 Day	11,20	12,64	5,03	<0.001	Yes
IOP Pre- vs. IOP Post-1 Week	8,60	14,32	3,59	<0.001	Yes
IOP Pre- vs. IOP Post-1 Month	13,23	13,56	5,82	<0.001	Yes
IOP Pre- vs. IOP Post-3 Months	16,91	12,81	7,78	<0.001	Yes
IOP Post-1 Day vs. IOP Post-1 Month	2,10	3,07	4,01	<0.001	Yes
IOP Post-1 Month vs. IOP Post-3 Months	3,69	3,71	5,89	<0.001	Yes


preoperative IOP and IOP at 1 day post-surgery was 11.12 mmHg (p<0.001), with a standard deviation of 12.64, indicating a substantial drop in IOP immediately after the procedure. Similarly, by the first week post-surgery, the IOP remained significantly lower than preoperative levels, with a mean difference of 8.60 mmHg (p<0.001), despite some variability (standard deviation 14.32).

The IOP reduction continued at 1 month post-surgery, with a mean difference of 13.23 mmHg compared to preoperative values p<0.001, reflecting a further sustained decline in IOP. By 3 months post-surgery, the mean difference between preoperative and postoperative IOP increased to 16.91 mmHg p<0.001, with a standard deviation of 12.81. This suggests that the IOP reduction not only persisted but became more pronounced over time, underscoring the long-term efficacy of the procedure in lowering IOP.

In addition to the preoperative comparisons, postoperative IOP values were analyzed to track changes between different intervals. When comparing IOP at 1 day vs. 1 month post-surgery, a significant reduction in IOP was again observed, with a mean difference of 2.10 mmHg (p<0.001), indicating that the IOP continued to decrease during the first month. The comparison between 1 month and 3 months post-surgery revealed a further drop in IOP, with a mean difference of 3.69 mmHg (p<0.001), demonstrating a continuous decline in IOP over the postoperative period.

An analysis of variance (ANOVA) was performed to assess whether there were significant differences in intraocular pressure (IOP) at 3 months postoperatively based on the diagnosis groups. The diagnoses included vitreous hemorrhages, rhegmatogenous retinal detachment, tractional retinal degeneration, and other retinal conditions. This analysis aimed to determine whether the different diagnoses had an impact on the IOP outcomes after triamcinolone-assisted vitrectomy.

The ANOVA revealed a statistically significant difference in IOP at 3 months between the diagnosis groups, as indicated by an F-value of 4.61 and a p-value of 0.009. This result suggests that the type of retinal condition significantly influences the postoperative IOP at the 3-month follow-up. The between-groups sum of squares was 356.69, while the within-groups sum of squares was 835.54, indicating that there is considerable variation both within and between the diagnosis categories.

Table 3. Analysis of variance (ANOVA) for intraocular pressure (IOP) at 3 months postoperative based on diagnosis groups.

Source	Sum of Squares (SS)	Degrees of Freedom (df)	Mean Square (MS)	F-value	p-value
Between Groups	356,69	3	118.90	4,61	0.009
Within Groups	835,54	31	26.95		
Total	1192,22	34			

Table 3 presents the full ANOVA results, summarizing the sources of variation, degrees of freedom, sum of squares, mean squares, F-value, and p-value.

DISCUSSION

This study aimed to evaluate the impact of triamcinolone-assisted vitrectomy on intraocular pressure (IOP) over a series of postoperative intervals. A significant reduction in IOP was observed both immediately after surgery and over time, particularly by the 3-month postoperative mark. These findings align with previous studies, which have highlighted the role of triamcinolone in improving surgical outcomes and controlling postoperative IOP through enhanced visualization and its anti-inflammatory properties.[2,14] Triamcinolone's role in vitreoretinal surgery has been well-documented across various studies, emphasizing its dual utility as both a staining agent and an adjunct for inflammation control.[5]

In this study, a significant reduction in IOP was observed at all postoperative intervals, starting from day 1, with a mean difference of 11.12 mmHg. The IOP continued to decline through the first week (mean difference: 8.60 mmHg), first month (mean difference: 13.23 mmHg), and third month (mean difference: 16.91 mmHg), indicating a sustained reduction in ocular pressure after surgery. These findings align with the results of previous studies, such as the one-year clinical trial of triamcinolone use in pars plana vitrectomy, where IOP was shown to decrease significantly over time.[15]

One of the most significant findings is the immediate reduction in IOP seen at 1 day postoperatively. The mean difference of 11.12 mmHg demonstrates the efficacy of triamcinolone in providing immediate relief of intraocular pressure following vitrectomy. This immediate effect is consistent with earlier research, which demonstrated that triamcinolone not only facilitates the removal of vitreous and membranes but also reduces IOP spikes that commonly occur post-surgery.[16-18]

In a study investigating the use of triamcinolone during vitrectomy, the authors observed that its anti-inflammatory properties played a key role in limiting postoperative IOP increases, especially in patients with uveitis.[19] Our findings align with this, as none of our patients experienced a significant IOP spike in the first 24 hours postoperatively, further supporting the hypothesis that triamcinolone's anti-inflammatory action helps mitigate acute IOP fluctuations.[20]

Moreover, triamcinolone's role in visualizing residual vitreous and membranes has been highlighted as a key factor in reducing complications during vitrectomy.[2,5] Incomplete removal of the vitreous is often associated with postoperative complications, including IOP spikes, due to inflammatory responses triggered by residual tissue.[21] By improving intraoperative visibility, triamcinolone assists surgeons in performing more thorough and complete vitreous removal, which may contribute to the early reduction in IOP observed in our study.[16-18]

The sustained reduction in IOP observed at 1 week, 1 month, and 3 months postoperatively further underscores the long-term benefits of triamcinolone-assisted vitrectomy. At 1 week, the mean IOP difference remained significant, at 8.60 mmHg, and by 1 month, the IOP had decreased further, with a mean

difference of 13.23 mmHg. This prolonged effect is consistent with findings from studies where triamcinolone was used not only for its staining properties but also as an anti-inflammatory agent to control postoperative inflammation and reduce the likelihood of prolonged IOP elevation.[16-18]

A key factor contributing to the sustained IOP reduction may be the continued suppression of postoperative inflammation by triamcinolone. Inflammation is a known contributor to IOP elevation, particularly in eyes with pre-existing conditions like glaucoma or diabetic retinopathy.[22] The anti-inflammatory properties of triamcinolone have been well-documented, with studies showing that its corticosteroid activity helps reduce postoperative inflammatory responses, thereby contributing to long-term IOP control. [23]

A similar study on the use of intravitreal triamcinolone in patients with diabetic macular edema observed a significant reduction in IOP at 1 month, suggesting that triamcinolone's benefits extend beyond short-term surgical outcomes. [24] In our study, the mean IOP difference reached 16.91 mmHg at 3 months postoperatively; this result supports the hypothesis that triamcinolone provides sustained IOP control. This aligns with research suggesting that the prolonged release of triamcinolone may contribute to its long-lasting effects on IOP.[15]

The analysis of variance (ANOVA) performed in our study revealed significant differences in IOP outcomes based on the underlying diagnosis. Patients with vitreous hemorrhage and rhegmatogenous retinal detachment exhibited the most significant reductions in IOP. These findings align with studies that have highlighted the unique challenges associated with treating retinal detachments and vitreous hemorrhages, where residual inflammation is often more severe, necessitating the use of agents like triamcinolone to control both surgical outcomes and postoperative inflammation.[16-18, 23]

The significant difference in IOP outcomes between diagnostic groups suggests that the effectiveness of triamcinolone in IOP management may be diagnosis-specific. Previous studies on diabetic retinopathy and proliferative vitreoretinopathy have also indicated varying degrees of success with triamcinolone, depending on the complexity of the disease. For instance, in cases of PVR, while triamcinolone aids in membrane visualization and removal, the inflammatory nature of the disease often results in delayed postoperative IOP control. Steroid therapy can influence both inflammatory and proliferative processes involved in PVR by reinforcing the blood-retinal barrier and reducing the activity of local growth factors and inflammatory cytokines. Ultimately, this may result in the suppression of RPE cell, fibroblast, and myofibroblast proliferation.[25,26]

Lens status (phakic vs. pseudophakic) has also been shown to influence postoperative outcomes, although its role in IOP control is less well understood. In our study, no significant difference in IOP outcomes was observed between phakic and pseudophakic patients. This finding contrasts with one study on instant glaucoma device injection, which suggested that pseudophakic eyes may be more prone to postoperative IOP spikes, possibly due to changes in aqueous humor dynamics.[27]

However, other studies have reported that pseudophakic eyes may experience more stable IOP outcomes post-vitrectomy, particularly when triamcinolone is used to manage inflammation and prevent secondary complications like posterior capsular opacification.[28] Our findings suggest that while lens status may play a role in some postoperative outcomes, its influence on IOP control is likely minimal when triamcinolone is used as part of the surgical protocol.

In addition to its role in IOP control, triamcinolone has been shown to reduce the incidence of postoperative complications by improving intraoperative visualization. This effect was particularly noted in our study, where no significant postoperative complications, such as endophthalmitis or retinal re-detachment, were observed. This aligns with findings from several studies, which have documented the utility of triamcinolone in reducing complications by ensuring complete removal of vitreous and membranes during surgery.[29]

In a study on macular hole surgery, for example, triamcinolone was found to significantly reduce the risk of retinal detachment, which is often associated with incomplete vitreous removal. By staining the vitreous and membranes, triamcinolone allows for more precise excision of pathological tissues, thereby minimizing the risk of postoperative complications. This benefit was similarly observed in our study, where improved visualization likely contributed to the successful surgical outcomes across the cohort.[30]

The use of triamcinolone also appears to have a protective effect against secondary IOP spikes, a common complication in vitrectomy. Steroid-induced IOP elevation is a known risk factor in vitreoretinal surgery; however, in our cohort, no significant IOP spikes were reported. This outcome may be related to the careful dosing and use of triamcinolone, as well as close postoperative monitoring.[31] Research on steroid-induced glaucoma has indicated that the incidence of IOP elevation can be minimized through appropriate dosing and patient selection,[32] findings supported by our study.

Clinical Implications and Recommendations

The results of this study highlight the importance of triamcinolone in managing postoperative IOP, particularly in high-risk patients with pre-existing glaucoma or ocular hypertension. Based on our findings, we recommend that triamcinolone be considered as part of the standard protocol for vitrectomy in patients with high baseline IOP, especially in cases of retinal detachment and vitreous hemorrhage. Studies have shown that triamcinolone not only reduces the risk of postoperative IOP elevation but also improves surgical outcomes by enhancing visualization during the procedure.[33,34]

For patients with more complex retinal conditions, such as proliferative vitreoretinopathy, a more nuanced approach may be required. Although triamcinolone is effective in these cases, the persistent inflammation associated with PVR may necessitate additional postoperative interventions, such as the use of anti-VEGF agents or other corticosteroids.[35] Future studies should explore the combination of triamcinolone with other therapeutic agents to optimize outcomes in these challenging cases.


CONCLUSION

This study highlights the significant impact of triamcinolone-assisted vitrectomy on reducing intraocular pressure (IOP) in the postoperative period. The findings confirm that triamcinolone, by improving vitreous visibility during surgery, not only facilitates the removal of membranes but also contributes to sustained IOP reduction over time. Immediate and significant drops in IOP were observed across all postoperative intervals, with the greatest reduction at 3 months.

Additionally, the study emphasizes that lens status (phakic vs. pseudophakic) does not play a substantial role in postoperative IOP outcomes, although patients with more complex retinal diseases, such as proliferative vitreoretinopathy (PVR), may require closer monitoring and additional postoperative interventions. Despite initial concerns about steroid-induced IOP spikes, triamcinolone's anti-inflammatory properties have shown benefits in controlling IOP, particularly when proper dosing and patient monitoring are employed.

In conclusion, triamcinolone is an effective surgical adjunct for improving visibility and managing IOP in both the immediate and long-term postoperative periods. These results support the continued use of triamcinolone in complex vitreoretinal surgeries, with recommendations for tailored postoperative management for patients with a higher risk of complications such as glaucoma.

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