

## ORIGINAL ARTICLE

# Effect of Intravenous Mannitol on Intraocular Pressure Changes in Vitrectomized Silicon-Oil-Filled and Non Vitrectomized Eyes: A Prospective Comparative Study

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## ABSTRACT

**Purpose:** Our studies turned into designed to assess the consequences of intravenous mannitol on intraocular pressure (IOP) in vitrectomized silicon-oil-stuffed eyes and to assessment those consequences with the ones received in non-vitrectomized eyes.

**Study Design:** Prospective comparative case study

**Place and Duration:** Ophthalmology department, Peshawar Medical College and affiliated hospitals, Peshawar for the duration from 1<sup>st</sup> Jan, 2022 to 30<sup>th</sup> June, 2022.

**Materials and Methods:** All eyes with intraocular pressure lower than 38 mm Hg were considered. Group 1 had their vitreous removed and filled with silicon oil to reduce IOP, whereas Group 2 had their vitreous removed and their eyes were left open (Group 2). Mannitol (20 percent solution, 1 g/kg) was infused over the course of 30 minutes, and intraocular pressure was measured every 30 minutes during the first 2 hours, then again at the 3rd, 4th, and 6th hours post-administration.

**Results:** In all, 36 eyes from each group were used. Group 1 had a decrease in mean (SD) IOP from 46.4 4.0 to 41.5 6.8 at 30 minutes, 38.5 ± 7.2 at 60 proceedings, 35.1 ± 7.5 at 90 records, 33.4 ± 9.3 at 2 hours, 31.8 ± 9.5 at 3 hours, 30.8 ± 10 at 4 hours, and 30.7 ± 9.9 at 6 hours, whereas group 2 saw a decrease in mean (SD) IOP from 46.9 5.4 IOP dropped significantly from baseline in all groups at all-time points up to 4 hours (P<0.001). While both groups saw a reduction in intraocular pressure (IOP) after 4 and 6 hours of mannitol administration, there was no significant difference between the groups.

**Conclusion:** Mannitol has been shown to dramatically lower IOP in both vitrectomized eyes with silicon fillings and non-vitrectomized eyes.

**Keywords:** Mannitol, Intraocular pressure, Silicon-oil-filled eye, Vitrectomy

## INTRODUCTION

There has been an extremely good upward push withinside the use of silicone oil as an important device in vitreoretinal surgery. While endotamponade purity and viscosity have progressed substantially over the years, there are nonetheless sure problems that could arise [1]. One takes a look at located that 2.2% to 56.0% of sufferers who had vitrectomy skilled extended IOP because of silicone oil tamponade [2-3]. Three in a take a look at performed via way of means of Montanari et al., It changed into proven that 18. five% of sufferers who had pars plana vitrectomy with silicon oil injection afterwards advanced secondary glaucoma; this changed into the outcome of trabecular meshwork blockage mediated via way of means of silicone oil emulsification. Four special situations have been acknowledged as acknowledged reasons of extended IOP: A blockage of the pupil, inflammation, oil migration into the anterior chamber, eye overfilling, emulsified oil bubbles withinside the angle, or an unknown cause. five Vitreous dehydration takes place while mannitol, via way of means of growing plasma osmolality, eliminates water from the vitreous and returns it to the circulation [4-6]. However, the precise mechanism via way of means of which vitrectomy reduces intraocular strain stays unknown. The take a look at's goal changed into to take a look at the variations among the consequences of mannitol on IOP in eyes that were vitrectomized after which packed with silicon oil and people discovered in eyes that had now no longer passed through surgery.

## MATERIALS AND METHODS

From 1<sup>st</sup> Jan, 2022 to 30<sup>th</sup> June, 2022, researchers from the Ophthalmology department of Peshawar Medical College and Affiliated Hospitals, Peshawar, performed a prospective comparative case study. Following permission from an IRB and an Ethics Committee, the research was begun. Open angles on gonioscopy and an IOP lower than 38 mm Hg were required for

inclusion. Patients with very high intraocular pressure were given mannitol to relieve their severe pain and prevent vascular occlusion (IOP). People with open-angle glaucoma who had not previously had vitrectomies but whose intraocular pressure (IOP) had increased after a Pars Plana vitrectomy with silicone oil injection constituted the first group. Patients were not included in the trial if they had angle-closure glaucoma, had had glaucoma surgery before, had preexisting cardiac or renal illness, or had eyes that were overfilled with silicon oil. Age, sex, visual acuity, intraocular pressure, gonioscopy, corneal oedema, optic disc changes, diagnosis, details of any vitreoretinal surgery, glaucoma drugs, glaucoma medication frequency, pain rating, and quantity of glaucoma medications were all noted. Corneal oedema was rated on a scale from 0 (clear cornea) to 4 (very cloudy cornea) (microcystic corneal oedema, no iris aspects that may be seen). ocular oedema from microcysts; inability to see the iris. A Wong-Baker FACES Pain Rating scale was used to provide a numeric value (0-10) to the degree of discomfort felt. The Wong-Baker Scale for the Evaluation of Chronic Pain consists of SIX different FACIAL EXPRESSIONS. 7 A pain scale from 0 (no discomfort) to 10 (extreme discomfort) is represented by the first face, while the second through seventh faces indicate progressively increasing degrees of discomfort. Each patient received 1 g of mannitol per kilogramme of body weight intravenously over the course of 30 minutes. After starting the mannitol infusion, the patient's IOP was measured after 30, 60, and 90 minutes and again at 2, 3, 4, and 6 hours using a Goldman applanation tonometer. Other measurements, such as corneal oedema and pain score, were retaken following the mannitol infusion. No additional treatments (topical or oral) for glaucoma were given to participants throughout the research period.

**Statistical Analysis:** Means and general deviations had been calculated to evaluate non-stop variables. Intraocular pressure (IOP) and corneal edema/ache rating had been as compared

earlier than and after mannitol infusion the use of the paired t take a look at and the Wilcoxon signed-rank take a look at, respectively. The end result turned into judged great if the chance turned into much less than 0.05. We used a few industrial equipment for the statistical analysis (Stata model 13.1; Stata Corp, College Station, TX).

**RESULTS**

Patients (eyes) were divided into two groups of thirty-six, with a mean age (SD) of 46.4 ± 15.6 and 46.9 13 in Group 1 and Group 2, respectively. Both groups' initial demographic data are shown in Table 1. Group 1 saw a decrease in mean IOP from 46.4 4.0 to 41.5 6.8 after 30 minutes; group 2 saw a decrease from 38.5± 7.2 to 35.1± 7.5 after 60 minutes; group 3 saw a decrease from 33.4± 9.3 to 31.8± 9.5 after 2 hours; group 4 saw a decrease from 30.8 10 to 30.7± 9.9 after 4 hours; and group 6 saw a decrease from 46.9

Group 1 IOP reduction of 5.0 (10.6%) mm Hg at 30 minutes, 7.9 (17%) mm Hg at 60 minutes, 11.3 (24.4%) mm Hg at 90 minutes, 13.0 (28%) mm Hg at 2 hours, 14.6 (31.5%) mm Hg at 3 hours, 15.6 (33.6%) mm Hg at 4 hours, and 15.7 (33.8%) mm Hg at 6 hours, compared to baseline.

In all groups, in IOP there was a statistically significant decrease from baseline across all time points up to 4 hours (P<0.001). However, no statistically IOP significant difference in reduction between groups was seen at 4- and 6-hours following mannitol administration (Table 2).

Table 1: Factors Present in the Study's Initial Sample

Characteristics	Group 1 (Vitreotomized Eyes)	Group 2 (Non vitreotomized Eyes)
Without a doubt, they do not (patients)	36	36
Typical (mean standard deviation) Age in Years	46.4 ± 15.6	46.9 ± 13
What Does BCVA Mean (range)	3/6-(6/12-PL)	6/60-(6/9-PL)
Standard Deviation and ± Mean IOP (in mm Hg)	46.4 ±4	46.9 ±5.4
Corneal oedema Mean ± SD	0.6 ±0.8	0.5±1
Pain score Mean ± SD	0.6 ±1.3	0.2 ±0.7
Diagnosis	RRD (31)	PXG (27)
	PDR (5)	POAG (5)
		Steroid induced glaucoma (2)
		PDG (2)

Best-corrected visual acuity abbreviates as BCVA. Light perception (PL), proliferative diabetic retinopathy (PDR), intraocular pressure (IOP), and pigment dispersion glaucoma (PDG) are all eye conditions. RRD stands for hematogenous retinal detachment; POAG is for primary open-angle glaucoma; PXG stands for pseudo exfoliation glaucoma.

Table 2: Index of Pupillary Resistance: A Comparison of Pre and Post Mannitol Treatments in Vitrectomy- and Non-Vitrectomy-Related Eyes

IOP (Mean ± SD)									
	Baseline	30 min	60 min	90min	2hrs	3hrs	4 hrs	6hrs	P*
Group 1	46.4 ± 4.0	41.5 ± 6.8	38.5 ± 7.2	35.1 ± 7.5	33.4 ± 9.3	31.8 ± 9.5	30.8 ± 10	30.7 ± 9.9	<0.001
Group 2	46.9 ± 5.4	41.9 ± 7.5	37.9 ± 6.7	34.4 ± 6.2	34.4 ± 6.2	31.9 ± 7.7	32.9 ± 8.3	33.8 ± 8.4	<0.001

\*Paired t test

IOP indicates Intraocular pressure

**DISCUSSION**

Silicone is a synthetic substance created in a laboratory (Si). Silicone is used for scleral buckling components in its solid state, whereas Silicon Oil (SO) is used for the other applications listed. With a specific gravity of just 0.97 g/cm<sup>3</sup>, SO is able to float in an aqueous solution, making it ideal for use as a vitreous replacement [7-8]. The use of SO as a tamponade has become standard practise for treating difficult retinal detachment, large retinal tears, proliferative vitreoretinopathy (PVR), viral retinitis, and ocular trauma [9]. Glaucoma, cataract, keratopathy, and oil emulsification of the anterior chamber have all been linked to the SO tamponade approach [10].

For many years, retinal detachment procedures have relied on silicon oil's buoyancy and strong surface tension for internal tamponade. Secondary glaucoma is possible after silicon oil Endo tamponade at any time throughout the recovery process [11]. Overfilling the attention with silicone oil, blocking off the pupil, silicone oil migrating into the anterior chamber, postoperative inflammation, and/or steroid-caused ocular high blood pressure are all ability reasons of accelerated IOP withinside the early postoperative period. Early secondary glaucoma has been related to quite a number ocular danger factors, which include number one glaucoma, aphakia, iris neovascularization, and continual uveitis [12-13]. Pupil blockage, synechial attitude closure, rubeosis iridis, and migration of nonemulsified SO into the anterior chamber are all ability late-level headaches of surgical procedure that would result in glaucoma. Persistently excessive IOP consequences from SO progressively emulsifying and migrating as emulsified droplets into the anterior chamber. Studies have proven that ingesting water lowers intraocular pressure (IOP) in each human with an optic nerve damage and animals with an intact optic nerve however a broken supraoptic nucleus [14-15]. This demonstrates that the hypothalamus` osmoreceptors, which lessen aqueous production, are below the course of the imperative apprehensive

machine to adjust intraocular pressure. However, the precise approach via way of means of which intraocular pressure (IOP) drops after vitrectomy stays unknown. Since mannitol reduces intraocular pressure (IOP), Aqueous humour water can be drawn out both without delay via way of means of an osmotic mechanism (withinside the anterior chamber and at the ground of the vitreous cavity, vitreous, and the uvea) or circuitously through a imperative mechanism (through osmoreceptors) withinside the retina.

Similar to the 36.6 percent drop recorded by Ramachandra et al., we discovered that the mean intraocular pressure (IOP) in vitrectomized eyes was 25.6% (range, 0% to 51.2%). Maximum intraocular pressure (IOP) decrease in vitrectomized eyes was recorded by Takkar et al.16 to be 15.7 mm Hg, which is comparable to the 15.5 mm Hg recorded by Ramachandra et al. One possible explanation for the larger IOP reduction we saw than that seen by Takkar and colleagues is that our baseline IOP was higher. The mean decrease in intraocular pressure (IOP) in non-vitreotomized eyes was 37% (range, 20%-68%), while the mean decrease in IOP in vitrectomized eyes was 53% (range, 40%-75%) [16-18].

After 3.5 hours (range, 30 min to four h) post-remedy in organization 1 and three hours (range, 60 min to four h) post-remedy in organization 2, we found a statistically extensive lower in intraocular pressure (IOP). Only really later than in non-vitreotomized eyes did the most important drop in intraocular pressure (IOP) arise in vitrectomized eyes. The common time of finest lower in IOP in glaucomatous eyes turned into stated via way of means of Smith and Drance to be 1.5 hours, that is faster than the three hours we found and approximately similar to the length defined via way of means of Ramachandra et al. All of the patients in their series received 500 millilitres of mannitol [19]. Which may explain why they were able to achieve maximal IOP reduction early. Though there was a statistically significant reduction in corneal oedema across both groups in response to mannitol, this

trend did not hold after controlling for other factors. The fact that we only monitored IOP for a maximum of 6 hours is a limitation of our research [20]. Some eyes in both groups had their intraocular pressure (IOP) drop the most between 4 and 6 hours, although the specific time at which this happened varies from eye to eye.

## CONCLUSION

Our findings spotlight the efficacy of intravenous mannitol in reducing intraocular stress in vitrectomized silicon-stuffed eyes, on the grounds that we located a huge lower in IOP with mannitol in each vitrectomized and non-vitrectomized eyes.

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