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TREATING UVEITIS-ASSOCIATED HYPOTONY WITH PARS PLANA VITRECTOMY AND SILICONE OIL INJECTION

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Abstract

Purpose—The purpose of this study was to determine the effect on intraocular pressure (IOP) and visual acuity of treating uveitis-related hypotony in patients with vitrectomy and intravitreal silicone oil injection.

Methods—Patients who underwent pars plana vitrectomy and silicone oil injection for uveitis-associated hypotony treatment were identified retrospectively. The primary outcome was maintaining an IOP of ≥5 mmHg. Visual acuity improvement was defined as an increase in ≥2 lines of acuity.

Results—Twelve eyes of 10 patients were identified. Median preoperative IOP was 2 mmHg (range: 0–7 mmHg). Two of 12 eyes had an IOP of ≥5 mmHg at presentation. The number of eyes with an IOP of ≥5 mmHg was 7 of 12 eyes (58%) at 1 month, 4 of 12 eyes (33%) at 3 months, 6 of 12 eyes (50%) at 6 months, and 3 of 9 eyes (33%) at 1 year. Five of 12 eyes (42%) were reinjected between 1 and 3 times with silicone oil for recurring hypotony. Median presenting Snellen visual acuity was counting fingers (range: 20/125 to light perception). Seven of 9 eyes (78%) maintained their preoperative vision at 1 year.

Conclusion—Intraocular pressure elevated modestly in most patients in this series. However, results were often transient, and some eyes required repeated silicone oil injections. Although silicone oil is reasonable to consider for the treatment and maintenance of IOP in patients with ocular hypotony secondary to uveitis, better treatments are needed.

Keywords

hypotony; silicone oil; uveitis

Ocular hypotony is an important complication of uveitis, complicated ocular surgeries, and cyclodestructive procedures.[1,2] Although there has been much progress in the treatment of ocular hypertension, there has been little progress toward extending ocular survival after hypotony.[1]

Chronic hypotony may lead to visual loss and structural changes that alter the function and appearance of the eye.[1] There is no consensus as to the definition of hypotony, because all

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eyes do not respond the same way to low intraocular pressure (IOP).[1,3] Therefore, the condition is a clinical diagnosis based on IOP and the anatomy of the eye.[1]

Intravitreal silicone oil is used by vitreoretinal surgeons in the repair of retinal detachments. One of the well-known side effects of intraocular silicone oil is elevated IOP.[4 – 8] Therefore, intravitreal silicone oil has been previously used in an attempt to maintain IOP in hypotonus eyes. This technique has shown some promise in a case series of 5 eyes with a 6-month follow-up.[2] This study reports the initial and long-term visual acuity (VA) and IOP outcomes of the eyes with hypotony and uveitis treated with pars plana vitrectomy and silicone oil injection at the University of Illinois Eye and Ear Infirmary. The aim of treatment was to stabilize and preserve the eyes, with perhaps some improvement in IOP and VA.

Methods

With institutional review board approval, a retrospective chart review of patients at the University of Illinois with a history of treatment of hypotony with 20-gauge pars plana vitrectomy and intravitreal silicone oil injections from November 1997 to November 2007 was conducted. All patients were taken to the operating room, and a standard 20-gauge pars plana vitrectomy was performed using preplaced sutures. All surgeries were performed using 5,000 centistoke silicone oil (Bausch and Lomb, Rochester, NY) on a 20-gauge cannula. The surgeries were performed by three different surgeons (M.P.B., L.J.U., and M.J.S.). Billing records were searched to identify patients who had both 1) a diagnosis of uveitis or hypotony and 2) undergone a vitrectomy. Patients with uveitis or hypotony were identified with the following International Statistical Classification of Diseases and Related Health Problems (ICD-9) codes commonly used at our institution (364.3, unspecified iridocyclitis; 360.30, hypotony, unspecified; 130.2, chorioretinitis due to toxoplasmosis; 136.1, Behçet syndrome; 364.00, acute and subacute iridocyclitis, unspecified; 364.10, chronic iridocyclitis, unspecified; 364.11, chronic iridocyclitis in diseases classified elsewhere; and 364.24, Vogt-Koyanagi syndrome). The following current procedural terminology codes were used in the search: 67025, injection of vitreous substitute; 67036, vitrectomy; 67038, vitrectomy, with epiretinal membrane stripping; 67039, vitrectomy, with focal endolaser photocoagulation; 67040, vitrectomy, with endolaser panretinal photocoagulation; 67108, repair of retinal detachment, with vitrectomy. Hypotony was defined as pressures at which the eye demonstrated decreased vision and other changes consistent with decreased IOPs, such as hypotony maculopathy. Data collected included demographic characteristics, cause of uveitis, VA, IOP, lens status, and corneal procedures performed. Intraocular pressure was measured by Goldmann applanation or pneumotonometry. Descriptive analysis was used to characterize outcomes. The primary outcome for this study was improvement in IOP, defined as ≥5 mmHg. The secondary outcome was improvement in VA, defined as an increase of two or more lines of vision, and VA was considered to be maintained if it did not change by more than one line. Patients with recurrent hypotony who were willing to undergo an additional operation underwent reinjection of silicone oil through a single 20-gauge pars plana incision.

Results

Forty-four patients with uveitis, low IOP, and vitrectomy were identified. After excluding patients with hypotony secondary to a rhegmatogenous retinal detachment and those without a minimum of 3 months of follow-up, 10 consecutive patients with 12 treated eyes were included.

The median duration of follow-up was 29 months, with a range of 6 months to 170 months. Ninety percent of the patients included were female. The median age of presentation with hypotony was 38 years (range: 8 –57 years). Sixty percent of the patients included were white, with the remaining being black. Four patients were diagnosed with idiopathic chronic iridocyclitis. Of the remaining six patients, each had a single diagnosis of one of the following: juvenile idiopathic arthritis-related iridocyclitis, idiopathic chronic granulomatous iridocyclitis, sarcoidosis-related chronic granulomatous iridocyclitis, pars planitis, Vogt Kayanagi Harada syndrome, or acute retinal necrosis. The median IOP at presentation was 2.0 mmHg (range: 0 –7 mmHg). The median documented duration of hypotony before surgery was 12.7 months. However, 80% of these eyes were hypotonus at the time of their first clinical examination by the uveitis service, so it is difficult to accurately account for duration. In addition to silicone oil injection, two patients were postoperatively treated with intracameral injection of sodium hyaluronate products (Healon GV; Advanced Medical Optics, Inc., Santa Ana, CA). Preoperatively, 100% of eyes were on oral steroids at some point of their treatment, but duration is unknown because these patients were referred to our center after chronic treatment. Short-term postoperative oral steroids were administered in 58.3% of eyes based on their inflammatory response, and 1 eye received intravitreal triamcinolone acetate at the time of the surgery. Five eyes were started on high doses of oral steroids tapered off by 1 month, and 2 were on a low dose for 3 months. Four of 12 eyes had both the vitreous and anterior chamber (AC) filled with silicone oil on initial injection. Of the remaining eight eyes with only vitreous fill on initial injection, three eyes had both the vitreous and AC filled with silicone oil on reinjection.

Pressure Outcomes

Results are summarized in Figure 1. Median preoperative IOP was 2 mmHg (range: 0 –7 mmHg), and 2 of 12 eyes started with a pressure ≥5 mmHg. Intraocular pressure was intentionally left high at the conclusion of the operations but declined thereafter. However, 5 of 12 eyes (42%) were reinjected between 1 and 3 times with silicone oil for recurring hypotony. The median time to first repeat injection of silicone oil was 3.73 months. The percentage of eyes with IOP of ≥5 mmHg was 7 of 12 eyes (58%) at 1 month, 4 of 12 eyes (33%) at 3 months, 6 of 12 eyes (50%) at 6 months, and 3 of 9 eyes (33%) at 1 year (Table 1). Of the 7 eyes that had an IOP of >5 mmHg at the 1-month visit, 4 retained this pressure at the 6-month visit. Four of 6 eyes in which the AC was completely filled either at the initial surgery or on reoperation had an IOP of ≥5 mmHg at the 6-month visit. However, only 2 of the 6 eyes without complete fill had an IOP of ≥5 mmHg at their 6-month visit.

Visual Acuity

Median presenting Snellen VA was counting fingers (range: 20/125 to light perception). Three of 12 eyes (25%) showed improvement of at least 2 lines of VA at 3 months. Two of 12 eyes (17%) maintained a 2-line improvement in VA at 6 months. At 1 year, 1 of 9 eyes (11%) demonstrated a 2-line improvement, and 7 of 9 eyes (78%) maintained their preoperative vision (Figure 2). All eyes that were reinjected (5 of 12) maintained their preoperative vision for a median duration of 22 months from the reinjection. Complete filling of the AC on initial surgery or on reoperation did not show any correlation to VA at the 6-month visit.

Ancillary Procedures

Of the 4 of 12 of eyes that had corneal procedures (corneal transplant and chelation of band keratopathy), all maintained their preoperative VA at 6 months. Three of the four eyes presented with band keratopathy before surgery, presumably secondary to their hypotony and uveitis. Initially, three eyes were aphakic, five eyes were pseudophakic, and four eyes were phakic preoperatively. Postoperatively, eight eyes were aphakic and four were

pseudophakic. No correlations were found between lens status and visual or pressure outcomes.

Discussion

Currently, there is no definitive treatment for ocular hypotony. It can lead to maculopathy, keratopathy, cataract formation, choroidal effusion, optic nerve edema, irregular astigmatism, and, ultimately, phthisis bulbi.[3] This study retrospectively reviewed patients treated at the University of Illinois Eye and Ear Infirmary to determine the long-term efficacy of intravitreal silicone oil in both maintaining IOP and VA in the eyes with uveitis and hypotony.

Intravitreal silicone oil injection has previously been described by Morse and McCuen[2] for the treatment of hypotony secondary to chronic uveitis. They were able to demonstrate an increase in IOP in 4 of 5 eyes at 6 months with a single injection. Two of the 5 eyes demonstrated a pressure >5 mmHg.[2] Three of the 5 eyes demonstrated 1 or more lines of improvement in Snellen VA at 6 months.[2] Our series of 12 eyes demonstrated similar results at 6 months for both VA and IOP. In fact even at 1 year, 7 of 9 eyes were able to maintain initial VA, and 1 eye had a 2-line improvement. Because this study was uncontrolled, the number of eyes that would have had stable vision without intervention is not known. Similarly, IOP at 1 year was higher than initial IOP in most patients (6 of 9), with 3 of 9 achieving a pressure of ≥5 mmHg. Again, pressure outcomes without intervention were not studied in this report, but the natural history of uveitic hypotony is that the IOP remains low or decreases.[1,2]

Other methods of treatment for ocular hypotony include intravitreal injection of viscoelastic and long-acting perfluorocarbon gas.[1,9,10] Tosi et al[9] demonstrated an increase of IOP to ≥5 mmHg at last follow-up (2–16 months) with intravitreal injection of 1.4% sodium hyaluronate. However, in their series, four of five eyes were hypotonus postretinal detachment repair. Patients with hypotony from retinal detachment were excluded from this study. Kucukerdonmez et al[11] demonstrated an increase in mean IOP to ≥5 mmHg at last follow-up after intravitreal sodium hyaluronate. However, only 6 eyes (19%) had hypotony from uveitis. In addition, initial IOP in these eyes is not clear. Although their data (including mostly nonuveitic etiologies) demonstrated higher “final” IOP in eyes with shorter duration of hypotony, few eyes with hypotony present for >3 months had a final IOP >5 mmHg. Hypotony from uveitis generally results from ciliary body dysfunction, whereas that after retinal detachment repair has a component of fluid egress caused by exposed retinal pigment epithelium. Our anecdotal experience with viscoelastic injections is that IOP elevation is quite transitory in the setting of chronic uveitic hypotony.

Gupta et al[12] have recently reported that, in eyes with hypotony secondary to chronic uveitis with normal appearing ciliary processes on ultrasound biomicroscopy, removal of ciliary membranes may be sufficient to restore IOP. However, in 27% of their patients (n = 4), particularly those with ciliary atrophy on ultrasound biomicroscopy, they found that silicone oil injection was necessary.

Ibopamine, a prodrug of epinine (deoxyepinephrine) that exhibits activity at dopaminergic and adrenergic receptors, has been reported to increase aqueous production. One interesting study reported a small increase in the area under the curve of IOP multiplied by hours after topical ibopamine administration in patients with chronic ocular hypotony. However, absolute change in IOP was <1 mmHg.[13]

An interesting phenomenon noted in our study is the decline in IOP after oil injection. Vitreoretinal surgeons at our institution routinely leave the IOP high at the conclusion of oil

injection for hypotony in anticipation of postoperative decline. It seems possible that increased intraocular volume from the oil causes expansion of the ocular coats with subsequent decline in pressure. It is possible that the first injection is needed to restore more normal globe size, and the subsequent injections are needed to elevate the IOP. Indeed, in this study, eyes with more than one injection of oil seemed to have better outcomes. In addition, eyes that had a complete oil fill, including the AC, had better IOP and similar, if not better, visual outcomes. This is likely because of maintenance of volume in eyes where aqueous outflow exceeds production. It is also possible that, over time, silicone oil is phagocytosed by trabeculocytes, leading to changes in the meshwork, a decrease in outflow of aqueous humor, and subsequent elevation of IOP.[14] Our case series also demonstrated that adjunctive procedures, such as chelation of band keratopathy and corneal transplantation, may be required to restore the maximal visual potential. However, it is also possible that eyes judged to have better potential were selected for additional procedures, introducing bias.

This retrospective case series contained a limited number of eyes, but it is the largest series describing oil injection for hypotony and the only one to specifically address hypotony related to uveitis. Although IOP was modestly elevated in most patients in this series, silicone oil was not universally successful, and the results were often transient. Although it is reasonable to consider performing silicone oil injection for the treatment of ocular hypotony, surgical success is limited. Further research into the treatment of uveitic hypotony is still needed.

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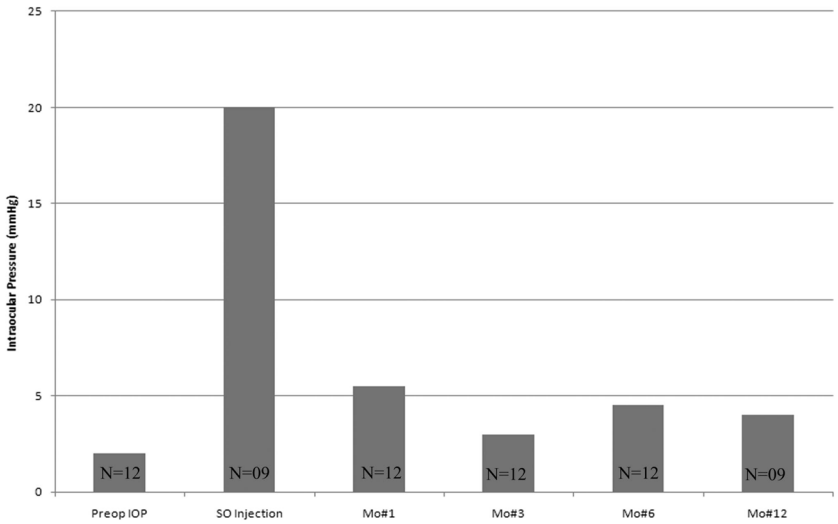

Fig. 1.

Bar graph displaying median IOPS over time. Intraocular pressure was intentionally left high at the end of surgery. Median IOP decreased initially and then seemed to plateau. Preop, preoperative; SO, silicone oil; Mo, postoperative month.

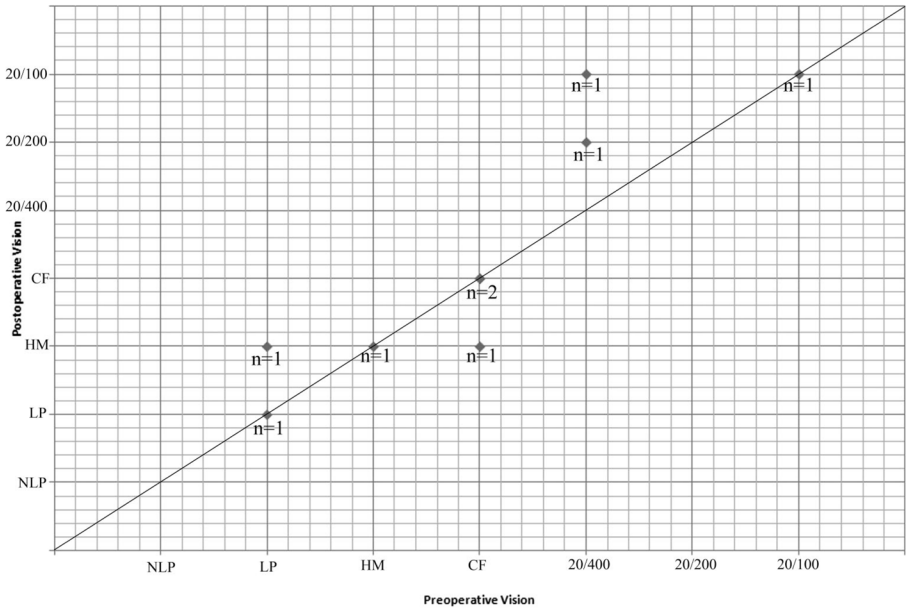

Fig. 2.

Line graph demonstrating preoperative Snellen visual acuity plotted against visual acuity at 1 year. Three eyes demonstrated improvement in Snellen visual acuity. Five eyes maintained preoperative visual acuity. NLP, no light perception; LP, light perception; HM, hand motions; CF, counting fingers.

Table 1

Preoperative and Postoperative Characteristics of Patients

Age (Years)/ Race/Gender	Cavity Filled With Oil Initially (Reoparative)	Cause	Initial		6-Month Follow-Up		1-Year Follow-Up		Repeat Silicone Oil Injection (Months)	Lens Status Preoperative/ Postoperative	Corneal Surgery
			VA	IOP (mmHg)	VA	IOP (mmHg)	VA	IOP (mmHg)			
20/W/M	Vitreous* (vitreous)	CIC/disseminated choroiditis	LP	6	LP	5	LP	0	4	Aphakic/aphakic	
20/W/F	Vitreous	JRA	HM	3	HM	0	HM	2	N	Phakic/aphakic	
36/W/F	Vitreous	ARN	CF	0	CF	8	CF	7	N	Phakic/pseudo	
58/B/F	Vitreous	CIC	LP	2	HM	0	HM	0	N	Pseudo/aphakic	
62/W/F	Vitreous	VKH	20/100	2	20/60	4	20/100	5	N	Pseudo/pseudo	
57/W/F	Vitreous (Vit/AC)	CIC	CF	0	CF	1	CF	4	1, 3, 12	Pseudo/pseudo	Band chelation
51/B/F	Vitreous†* (Vit/AC)	CIC	20/400	2	20/70	0	20/100	7	14	Pseudo/aphakic	PKP, Band chelation
25/W/F	Vitreous (Vit/AC)	Pars planitis/JRA	20/400	1	20/200	6	20/200	4	2, 37, 40	Aphakic/aphakic	Band chelation
	Vit/AC (Vit/AC)	Pars planitis/JRA	CF	2	CF	5	HM	4	5, 14	Aphakic/aphakic	Band chelation
54/B/F	Vit/AC	Sarcoid CGIC	CF	1	HM	10	NA	NA	N	Pseudo/pseudo	
43/B/F	Vit/AC	CGIC	HM	0	CF	3	NA	NA	N	Phakic/aphakic	
	Vit/AC	CGIC	HM	7	CF	8	NA	NA	N	Phakic/aphakic	

*Sodium hyaluronate in AC.

†Intravitreal Kenalog.

AC, anterior chamber; ARN, acute retinal necrosis; B, African American; CF, counting fingers; CGIC, chronic granulomatous iridocyclitis; CIC, chronic iridocyclitis; F, female; HM, hand motions; JRA, Juvenile idiopathic arthritis; LP, light perception; M, male; N, none; NA, not available; PKP, penetrating keratoplasty; Vit, vitreous; VKH, Vogt Koyanagi syndrome; W, white.