Original Article

The Long Term Outcome of Ahmed Glaucoma Valve Insertion in Neovascular Glaucoma

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Abstract

Purpose: To evaluate the efficacy of Ahmed glaucoma valve (AGV) implantation for neovascular glaucoma (NVG), in short, intermediate, and long term follow ups.

Patients and Methods: The present study was a retrospective review of 23 eyes of 23 patients with NGV who underwent AGV implantation at Imam Hussein Medical Center, Tehran, Iran, between January 2008 and March 2017. Pre and post operative intraocular pressure (IOP), visual acuity, surgical success rate, number of medications, and complications were recorded. The primary outcome was surgical success defined in terms of $5 \leq IOP \leq 21$ mmHg and at least 20 % reduction in IOP without glaucoma medication (complete success), or with medications (qualified success). The sum of complete success and qualified success was reported as cumulative success.

Results: The mean follow up period was 4.69 years (range, 2-10 years). The mean IOP was significantly lower compared to preoperative mean at each postoperative visit up to three years ($P < 0.001$). The cumulative surgical success rate at 1 year, 2 years and 3 years were 91.3 %, 82.6 %, 78.3 % respectively. The mean number of drugs needed to control IOP was significantly lower compared to preoperative mean at each postoperative visit up to three years.

Conclusion: It seems that AGV insertion is a safe and effective surgical method to treat neovascular glaucoma with acceptable success rates up to three years post operatively. More prospective studies with higher number of participants are recommended to better evaluate the success rate of AVG implantation to treat patients with neovascular glaucoma.

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Introduction

Neovascular glaucoma (NVG) is a refractory and aggressive type of secondary glaucoma that is accompanied by iris and chamber angle neovascularization and often results in poor visual outcomes [1,2]. This catastrophic form of glaucoma has been reported in many ocular diseases, especially in diabetes mellitus, central retinal vein occlusion, and ocular ischemic syndrome [3,4]. Fibrovascular tissue in the angle obstructs the trabecular meshwork and results in outflow resistance as well as peripheral anterior synechiae causing higher intraocular pressure [5].

Intraocular pressure (IOP) lowering medications, anti vascular endothelial growth factor (VEGF) injections, and panretinal photocoagulation (PRP) are most of the time insufficient for controlling the intraocular pressure among these patients [5]. The use of glaucoma drainage devices has increased for treating neovascular glaucoma because the surgical failure of trabeculectomy even with antimetabolites usage is as high as 80 % [6-9]. These devises have a significantly lower frequency of adverse events in comparison with trabeculectomy [10].

Although cycloablation procedures can reduce the IOP among these patients but their complications such as phthisis are unacceptable [11-13].

In the present study we aimed to evaluate the long-term results and success rate of AGV implementation in patients with neovascular glaucoma.

Patients and Methods

In this retrospective study, all neovascular glaucoma patients who underwent AGV insertion in Imam Hossein Medical Center, Tehran, Iran, between January 2008 and March 2017 were included. The study was approval by the Ethics Committee of Shahid Beheshti University of Medical Sciences, Tehran, Iran and all patients gave a written consent before entering the study. The results of best corrected visual acuity (BCVA), IOP (measured by calibrated Goldmann applanation tonometry), slit lamp biomicroscopy, funduscopic examination (using a 90 diopter lens), number of glaucoma medications and complications were recorded for all patients entering the study from their medical files.

The primary outcome in the present study was surgical success defined in terms of $5 \leq IOP \leq 21$ mmHg and at least 20 % reduction in IOP without glaucoma medication (complete success), or with medications (qualified success). The sum of complete success and qualified success was reported as cumulative success. Failure was defined as IOP < 5 mmHg or more than 21 mmHg in at least two consecutive visits, need for AGV removal or secondary anti glaucoma surgery or visual acuity of no light perception in the follow up period.

Hypertensive phase (HP) was defined as IOP > 21 mmHg during the first 3 months without tube obstruction or retraction.

Surgical technique

In all patients, the AGV was implanted in superotemporal quadrant by three glaucoma surgeons according to the same technique. After performing a limbal based conjunctival flap the AGV (model FP7, New World Medical, Rancho Cucamonga, CA, USA) was primed, and the plate was secured to the sclera with 7-0 silk sutures 8-9 mm behind the limbus, then the AGV was inserted into the anterior chamber parallel to iris. At this point the scleral patch graft was sutured on the tube and then conjunctiva was stitched with 10-0 nylon sutures. Postoperatively, all patients

received chloramphenicol eye drops 4 times a day for 1 week and betamethasone eye drops every 2 hours, which was tapered over the next 6 to 8 weeks. Patients were examined on the postoperative day 1, then at least weekly for 4 weeks, and then every 3 months or according to the surgeon's judgment. Anti glaucoma medication was started based on surgeon's decision if the target pressure was not achieved in follow up exams.

Results

Twenty three eyes of 23 patients (11 males and 12 females) with mean age of 57.08 ± 10.79 years and preoperative visual acuity of 1.84 ± 1.07 LogMAR were enrolled in this retrospective study. The mean duration of follow up was 4.69 years (range, 2-10 years). We did not include data from patients with more than 3 years of follow up since we had more than 20 percent of patients lost to follow up after the third year. The mean preoperative IOP was 33.47 ± 9.61 mmHg, and the mean postoperative IOP was 16.39 ± 7.9 mmHg at year 1, 16.78 ± 7.35 mmHg at year 2, and 16.95 ± 9.05 mmHg at year 3 ($P < 0.001$) (Table 1). Table 2 shows the mean number of anti-glaucoma medications pre-surgery and after AGV implantation and Table 3 shows the success rate of AGV implantation in follow ups up to three years. Hypertensive phase occurrence was 65 % in our patients. Considering complications there were 4 cases (17.4 %) with choroidal effusion and 2 cases (8.7 %) with AGV exposure.

Discussion

Neovascular glaucoma (NVG), a complicated secondary glaucoma, is caused by retinal ischemic diseases [5]. Ischemia causes the release of angiogenic factors and results in neovascularization of the iris and the angle [5]. Nowadays with the increasing number of diabetic patients, the number of NVG is also increasing accounting for more than 30 % of refractory glaucomas [1]. In the present study we reported the outcome of patients with AGV insertion to treat NVG up to three years, which is a relatively high follow up period. Complete success rate of surgery in our patients was 17.4 % up to three years postoperatively and the cumulative success was 91.3 % at one year post operatively, 82.6 % at two years postoperatively and 78.3 % at three years

Table 1: Comparison of the mean intraocular pressure pre-surgery and after AGV implantation

Mean IOP	Mean ± Std	P value *	N
Before surgery	33.47 ± 9.61	< 0.001	23
1 month after surgery	14.04 ± 7.03	< 0.001	23
3 months after surgery	15.52 ± 6.52	< 0.001	23
6 months after surgery	15.39 ± 8.27	< 0.001	23
9 months after surgery	15.78 ± 7.02	< 0.001	23
1 year after surgery	16.39 ± 7.9	< 0.001	23
2 years after surgery	16.78 ± 7.35	< 0.001	23
3 years after surgery	16.95 ± 9.05	< 0.001	21

* Wilcoxon Test

Table 2: Comparison of the mean number of anti-glaucoma medications pre-surgery and after AGV implantation

Mean Number of Medications	Mean ± Std	P value *	N
Before surgery	3.43 ± 0.99	-	23
1 month after surgery	0.43 ± 0.72	< 0.001	23
3 months after surgery	1.04 ± 0.92	< 0.001	23
6 months after surgery	1.39 ± 1.11	< 0.001	23
9 months after surgery	1.69 ± 1.18	< 0.001	23
1 year after surgery	1.73 ± 1.25	< 0.001	23
2 years after surgery	2.13 ± 1.48	0.022	23
3 years after surgery	2.19 ± 1.56	0.024	21

*Chi-Square test

Table 3: The success rate of patients in follow ups up to three years

		Success				
Variable		Fail	Fail %	Success	Success %	Total
Year	1	2	8.7 %	21	91.3 %	23
	2	4	17.4 %	19	82.6 %	23
	3	5	21.7 %	18	78.3 %	23

postoperatively. In a previous study by Yalvac et al., [14] the cumulative rate of success was reported to be 63.2 % at 1 year, 56.2 % at 2 years, and 43.2 % at 3 years. In another study by Netland et al., [15] the success was 73.1 % at 1 year, 61.9 % at 2 years, and 20.6 % at 5 years. Also Shen et al., [16] reported a success rate of 70 % at 1 year, and 60 % at 2 years after AGV insertion in neovascular glaucoma patients.

It seems that our results show a relatively higher success rate compared to other studies. This might be due to different patient selection criteria or success criteria used in different studies.

Considering complications we observed choroidal effusion in 17.4 % of our patients. In comparison Shen et al., [16] reported choroidal effusion in 5 % of their patients, Netland et al., [15] reported choroidal effusion in 15.8 % and Yalvac et al., [14] reported choroidal effusion in 5.3 % of their patients. We observed implant exposure in 8.7 % of our patients while there was a 5.3 % rate of implant exposure in the study by Netland et al., [15].

The strength of the present study was its relatively long follow up period of three years, while it was limited by its retrospective methodology and relatively low number of participants. More prospective studies with higher number of participants are recommended to better evaluate the success rate of AVG implantation to treat patients with neovascular glaucoma.

Conclusion

It seems that AGV insertion is a safe and effective surgical method to treat neovascular

glaucoma with acceptable success rates up to three years post operatively. More prospective studies with higher number of participants are recommended to better evaluate the success rate of AVG implantation to treat patients with neovascular glaucoma.

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Footnotes and Financial Disclosures

Conflict of interest:

The authors have no conflict of interest with the subject matter of the present study.