Original Article

Short, Intermediate and Long Term Results of Ahmed Glaucoma Valve Implantation

Maryam Yadgari [1], MD; Kiana Hassanpour *[1], MD; Nader Nassiri [1], MD; Hossein Mohammad-Rabei [2], MD; Zohreh Behrouzi [3], MD

1. Imam Hossein Medical Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
2. Cornea and Refractive Surgery Service, Torfeh Medical Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran.
3. Ophthalmic Epidemiology and Prevention of Blindness Center, Shahid Beheshti University of Medical Science, Tehran, Iran.

***Corresponding Author:** Kiana Hassanpour
E-mail: kiana.hassanpour@gmail.com

Article Notes:

Received: Apr. 28, 2018
Received in revised form: Jun. 17, 2018
Accepted: Aug. 20, 2018
Available Online: Sep. 29, 2018

Key words:

Glaucoma
Intraocular pressure
Ahmed glaucoma valve
Treatment outcome

Abstract

Purpose: To evaluate the efficacy and safety of Ahmed glaucoma valve (AGV) implantation for glaucomatous eyes in short, intermediate, and long term follow up periods.

Patients and Methods: In this retrospective study 76 eyes of 76 patients who underwent AGV insertion in Imam Hossein Medical Center, Tehran, Iran, between January 2008 and March 2017 with at least three years of followup were included. At each visit complete ophthalmic examination was performed and the success rate of surgery was assessed. Surgical success was defined as $5 \leq$ IOP $\leq$ 21 mmHg and at least 20 % reduction in IOP without any glaucoma medication (complete success), or with the use of anti glaucoma medications (qualified success). The sum of complete and qualified success was reported as cumulative success.

Results: The mean age of patients was 53.18 ± 16.92 years and the mean duration of follow up was 3.27 ± 2.36 years (range: 1-5 years). The complete surgical success rate was 20 % at 1 year, 18 % at 2 years, 16 % at 3 years, 15 % at 4 years, and 8 % at 5 years of followup and there was no medication free patient at more than 5 years followup. The cumulative success rate was 91 %, 88 %, 84 %, 80 %, and 77 % at 1 to 5 years of followup respectively.

Conclusion: Ahmed glaucoma valve (AGV) implantation for glaucomatous eyes results in acceptable IOP reduction and less medication need in short, intermediate, and long term follow up periods.

How to cite this article: Yadgari M, Hassanpour K, Nassiri N, Mohammad-Rabei H, Behrouzi Z . Short, Intermediate and Long Term Results of Ahmed Glaucoma Valve Implantation . Journal of Ophthalmic and Optometric Sciences . 2018;2(4): 12-7.

Introduction

Glaucoma is a leading cause of irreversible blindness worldwide [1]. Treatment of glaucoma is usually performed using drug therapy, but in certain conditions like congenital glaucoma, poor compliance, lack of awareness, and progressive disease, surgical intervention becomes the first choice of treatment [2]. Various surgical approaches have been proposed to treat refractory glaucomas such as trabeculectomy, cyclodestructive procedures, and glaucoma drainage devices [3]. Glaucoma drainage devices drain aqueous humor from the anterior chamber to external subconjunctival space [4,5]. Indications for implantation of these devices include eyes with refractory glaucoma such as neovascular glaucoma, uveitic glaucoma, glaucoma in aphakia and pseudophakia, glaucoma associated with trauma, vitreoretinal disorders, penetrating keratoplasty and eyes which have failed previous filtration surgery [6,7]. The history of aqueous shunts dates back to more than 100 years ago with the use of a range of materials to accomplish artificial translimbal or transscleral drainage of aqueous humor [8,9].

Various aqueous shunting devices, including restrictive and nonrestrictive implants, are used to manage complicated glaucoma which is resistant to medical therapy and traditional filtering surgery. The non-restrictive devices, such as Molteno and Baerveldt valves, have been associated with the development of hypotony after the early postoperative period [10,11]. The restrictive devices, such as Krupin and Ahmed valves, contain a design which restricts the flow of aqueous humor to eliminate the incidence of hypotony [12,13]. The Ahmed glaucoma valve (AGV) implant (New World Medical, Rancho Cucamonga, CA, USA) was introduced to the market in 1993 [12]. The overall success rate of AGV insertion varies among different types of glaucomas, ranging from 63 % to 100 % at one year of follow-up in different case series with different success criteria [14,15]. Results of the tube versus trabeculectomy (TVT) study support the expanding use of tube shunts beyond refractory glaucomas [16]. However, long-term follow-up data regarding this usage are limited. The purpose of the present study was to evaluate the short, intermediate and long term (up to 5 years) efficacy and complications of AGV implantation.

Patients and Methods

This retrospective study included 76 patients (46 males and 30 females) who had undergone AGV insertion at Imam Hossein Medical Center, Tehran, Iran, between January 2008 and March 2017, with at least 3 years of follow up. The study design was approval by the Ethics Committee of Shahid Beheshti University of Medical Sciences, Tehran, Iran. Best corrected visual acuity (BCVA), IOP (measured by calibrated Goldmann applanation tonometry), slit lamp biomicroscopy results, funduscopic exam results (using 90 diopter lens), and the number of glaucoma medications and complications were recorded. Surgical success was defined as $5 \leq IOP \leq 21$ mmHg and at least 20 % reduction in IOP without any glaucoma medication (complete success), or with the use of anti glaucoma medications (qualified success). The sum of complete and qualified success was reported as cumulative success.

Failure was defined as not fulfilling the success criteria in two consecutive visits or a need for AGV removal or secondary anti glaucoma surgery in the follow up period.

Surgical technique

In all patients, the AGV was implanted in

superotemporal quadrant according to the same technique. A limbal- basad conjunctival flap was fashioned in superotemporal quadrant. 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 9 mm behind the limbus and inserted into the anterior chamber parallel to iris after beveled up trimming. A scleral patch graft was sutured as a cover on the tube and then the overlying conjunctiva was stitched with 10-0 nylon sutures using the running method. Postoperatively, all patients were prescribed chloramphenicol eye drops 4 times a day for 1 week and betamethasone eye drops every 2 hours, which was tapered over the next 6-8 weeks. Patients were examined on the postoperative day 1, then weekly for 4 weeks, and then every 3 month. IOP lowering medication was initiated and continued on surgeon decision when the target pressure was not gained.

Results

In this retrospective study 76 eyes of 76 patients (46 male and 30 female) who had undergone AGV insertion with at least 3 years of follow up were studied. The mean age of patients was 53.18 ± 16.92 years and the mean duration of follow up was 3.27 ± 2.36 years (range: 1-5 years). The mean best corrected visual acuity was 1.65 ± 1.07 at the time of surgery. Forty one patients were phakic, 26 patients were pseudophakic and 9 cases were aphakic. Table 1 shows the types of glaucoma in patients enrolled in the study.

Table 2 shows the mean IOP among patients before the surgery and 3 months, 6 months, 9 months, one year, two years, three year, four years, and 5 years postoperatively. The mean IOP was significantly lower in all post surgical exams up to 5 years.

Table 1: Type of glaucoma in patients enrolled in the present study

Glaucoma type		
Description	Number	Percent
Neovascular glaucoma	23	30 %
Primary open angle glaucoma	14	18 %
Complicated cataract	9	12 %
Traumatic	8	11 %
Post vitrectomy	8	11 %
Chronic angle closure glaucoma	7	9 %
Pseudoexfoliation	2	3 %
Fuchs Heterochromic Iridocyclitis	2	3 %
Congenital cataract	1	1 %
Uveitic glaucoma	1	1 %
Aphakic glaucoma	1	1 %
Sum	76	100 %

Table 3 shows the mean number of medications used by patients before the surgery and 3 months, 6 months, 9 months, one year, two years, three years, four years, and 5 years postoperatively. The mean number of medications was also significantly lower in all post surgical exams up to 5 years.

There was no effect of glaucoma type on success rate. The complete surgical success rate was 20 % at 1 year, 18 % at 2 years, 16 % at 3 years, 15 % at 4 years, and 8 % at 5 years of followup and there was no medication free patient at more than 5 years followup. The cumulative success rate was 91 %, 88 %, 84 %, 80 %, and 77 % at 1 to 5 years of followup respectively.

Two patients (2.6 %) needed repeated anti glaucoma surgery. Regarding complications 6 cases with choroidal effusion were observed; two cases underwent surgical drainage and

Table 2: Comparison of the mean IOP among patients before the surgery and post surgical exams up to 5 years

Description	Before Surgery	3 months	6 months	9 months	1 Year	18 months	2 Year	3 Year	4 Year	5 Year
Mean ± Std	28.71 ± 9.23	13.4 ± 4.93	13.73 ± 5.84	13.73 ± 4.88	14.15 ± 5.24	14.46 ± 4.81	15.30 ± 5.98	15.47 ± 6	16.36 ± 7.33	17.16 ± 7.63
range	40 (14 to 54)	34 (5 to 39)	35 (7 to 42)	36 (7 to 43)	33 (7 to 40)	33 (6 to 39)	34 (8 to 42)	34 (6 to 40)	32 (8 to 40)	31 (9 to 40)
P value *	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
N	76	76	76	76	76	76	76	76	41	25

* Wilcoxon Test

Table 3: Comparison of the mean number of IOP lowering medications used by patients before the surgery and in post surgical exams up to 5 years

Description	Before Surgery	3 months	6 months	9 months	1 Year	18 months	2 Year	3 Year	4 Year	5 Year
Mean ± Std	3.44 ± 0.8	1.03 ± 1.07	1.5 ± 1.29	1.59 ± 1.28	1.82 ± 1.36	2 ± 4.81	2.15 ± 1.4	2.22 ± 1.39	2.31 ± 1.55	2.48 ± 1.53
range	4 (0 to 4)	4 (0 to 4)	4 (0 to 4)	4 (0 to 4)	4 (0 to 4)	4 (0 to 4)	4 (0 to 4)	4 (0 to 4)	4 (0 to 4)	4 (0 to 4)
P value *	-	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001
N	76	76	76	76	76	76	76	76	41	25

*Chi-Square

four cases improved spontaneously. We also had 2 cases of decompensated cornea and 2 cases of hyphema without AGV failure.

Discussion

The concept of designing a modern drainage device for glaucoma control was introduced several decades ago [17-21]. The role of glaucoma drainage devices in controlling glaucoma has progressively increased due to improvements in design, materials, and manufacturing techniques leading to fewer complications caused by poor flow control and tissue compatibility [22-28].

The success rate of AGV insertion has been reported to be from 63 % to 100 % at one year of follow-up in the literature, but there is limited knowledge about the long term results of this surgery [14-15]. In our study we reviewed preoperative, intraoperative and postoperative information of 76 eyes from 76 patients who had undergone AGV insertion and had at least 3 years of follow up and observed 91 %, 88 %, 84 %, 80 % and 77 % of cumulative success rate at one to five years respectively. In comparison a randomized clinical trial conducted by Wilson et al., [29] comparing trabeculectomy and AGV implants in patients requiring glaucoma surgical intervention with or without prior glaucoma surgery reported success rates of 83.6 % and 88.1 % at one year, respectively. In another retrospective

study conducted by Souza et al., [3] long term outcomes of AGV insertion in refractory glaucoma was evaluated among 78 eyes with a minimum of three years of follow up. They reported an 80 % success rate at one year, and 73 %, 63 %, 54 %, and 49 % success rates at two, three, four, and five years, respectively [3]. It seems that our results are better than the results reported by Sousa et al., [3] even with nearly similar success definitions. The probable cause might be inclusion of more complicated glaucoma types in their study. In Souza et al., [3] study the need for reoperation was 5 % which is comparable to our results (2.6 %).

We observed that the mean number of medications one year after AVG implantation was reduced to 1.82 ± 1.36 drugs. In tube versus trabeculectomy study at 1year after shunt procedures the mean number of anti-glaucoma medications was more than 1, which is comparable with our results [16].

The strength of the present study was its long term follow-up period up to 5 years while it was limited by its retrospective nature and its relatively limited number of participants.

Conclusion

Ahmed glaucoma valve (AGV) implantation for glaucomatous eyes results in acceptable IOP reduction and less medication need in short, intermediate, and long term follow up periods.

Authors ORCIDs

Maryam Yadgari:
https://orcid.org/0000-0003-0829-1861
Kiana Hassanpour:
https://orcid.org/0000-0002-1788-7352

References

1. Quigley HA, Broman AT. The number of people with glaucoma worldwide in 2010 and 2020. Br J Ophthalmol. 2006;90(3):262-7.

2. Harasymowycz P, Birt C, Gooi P, Heckler L, Hutnik C, Jinapriya D, et al. Medical Management of Glaucoma in the 21st Century from a Canadian Perspective. J Ophthalmol. 2016;2016:6509809.

3. Souza C, Tran DH, Loman J, Law SK, Coleman AL, Caprioli J. Long-term outcomes of Ahmed glaucoma valve implantation in refractory glaucomas. Am J Ophthalmol. 2007;144(6):893-900.

4. Brasil MV, Rockwood EJ, Smith SD. Comparison of silicone and polypropylene Ahmed Glaucoma Valve implants. J Glaucoma. 2007;16(1):36-41.

5. Syed HM, Law SK, Nam SH, Li G, Caprioli J, Coleman A. Baerveldt-350 implant versus Ahmed valve for refractory glaucoma: a case-controlled comparison. J Glaucoma. 2004;13(1):38-45.

6. Assaad MH, Baerveldt G, Rockwood EJ. Glaucoma drainage devices: pros and cons. Curr Opin Ophthalmol. 1999;10(2):147-53.

7. Schwartz KS, Lee RK, Gedde SJ. Glaucoma drainage implants: a critical comparison of types. Curr Opin Ophthalmol. 2006;17(2):181-9.

8. Lim KS, Allan BD, Lloyd AW, Muir A, Khaw PT. Glaucoma drainage devices; past, present, and future. Br J Ophthalmol. 1998;82(9):1083-9.

9. Minckler DS, Francis BA, Hodapp EA, Jampel HD, Lin SC, Samples JR, et al. Aqueous shunts in glaucoma: a report by the American Academy of Ophthalmology. Ophthalmology. 2008;115(6):1089-98.

10. Wilson RP, Cantor L, Katz LJ, Schmidt CM, Steinmann WC, Allee S. Aqueous shunts. Molteno versus Schocket. Ophthalmology. 1992;99(5):672-6; discussion 676-8.

11. Siegner SW, Netland PA, Urban RC Jr, Williams

AS, Richards DW, Latina MA, et al. Clinical experience with the Baerveldt glaucoma drainage implant. Ophthalmology. 1995;102(9):1298-307.

12. Fellenbaum PS, Almeida AR, Minckler DS, Sidoti PA, Baerveldt G, Heuer DK. Krupin disk implantation for complicated glaucomas. Ophthalmology. 1994;101(7):1178-82.

13.Coleman AL, Hill R, Wilson MR, Choplin N, Kotas-Neumann R, Tam M, et al. Initial clinical experience with the Ahmed Glaucoma Valve implant. Am J Ophthalmol. 1995;120(1):23-31.

14. Da Mata A, Burk SE, Netland PA, Baltatzis S, Christen W, Foster CS. Management of uveitic glaucoma with Ahmed glaucoma valve implantation. Ophthalmology. 1999;106(11):2168-72.

15. Yalvac IS, Eksioglu U, Satana B, Duman S. Long-term results of Ahmed glaucoma valve and Molteno implant in neovascular glaucoma. Eye (Lond). 2007;21(1):65-70.

16. Gedde SJ, Singh K, Schiffman JC, Feuer WJ. Tube Versus Trabeculectomy Study Group. The Tube Versus Trabeculectomy Study: interpretation of results and application to clinical practice. Curr Opin Ophthalmol. 2012;23(2):118-26.

17. Lim KS, Allan BD, Lloyd AW, Muir A, Khaw PT. Glaucoma drainage devices; past, present, and future. Br J Ophthalmol. 1998;82(9):1083-9.

18. Ellis RA. Reduction of intraocular pressure using plastics in surgery. Am J Ophthalmol. 1960;50:733-42.

19. Molteno AC. New implant for drainage in glaucoma. Clinical trial. Br J Ophthalmol. 1969;53(9):606-15.

20. Lee PF, Wong WT. Aqueous-venous shunt for glaucoma: report on 15 cases. Ann Ophthalmol. 1974;6(10):1083-8.

21. Krupin T, Podos SM, Becker B, Newkirk JB. Valve implants in filtering surgery. Am J Ophthalmol. 1976;81(2):232-5.

22. Molteno AC. The optimal design of drainage implants for glaucoma. Trans Ophthalmol Soc N Z. 1981;33:39-41.

23. Joseph NH, Sherwood MB, Trantas G, Hitchings RA, Lattimer L. A one-piece drainage system for glaucoma surgery. Trans Ophthalmol Soc U K. 1986;105 (Pt 6):657-64.

24. Heuer DK, Lloyd MA, Abrams DA, Baerveldt G, Minckler DS, Lee MB, et al. Which is better? One or two? A randomized clinical trial of single-plate versus double-plate Molteno implantation for glaucomas in aphakia and pseudophakia. Ophthalmology. 1992;99(10):1512-9.

25. Smith SL, Starita RJ, Fellman RL, Lynn JR. Early clinical experience with the Baerveldt 350-mm2 glaucoma implant and associated extraocular muscle imbalance. Ophthalmology. 1993;100(6):914-8.

26. Jacob JT, Burgoyne CF, McKinnon SJ, Tanji TM, LaFleur PK, Duzman E. Biocompatibility response to modified Baerveldt glaucoma drains. J Biomed Mater Res. 1998;43(2):99-107.

27. Ayyala RS, Harman LE, Michelini-Norris B, Ondrovic LE, Haller E, Margo CE, et al. Comparison of different biomaterials for glaucoma drainage devices. Arch Ophthalmol. 1999;117(2):233-6.

28. Ayyala RS, Michelini-Norris B, Flores A, Haller E, Margo CE. Comparison of different biomaterials for glaucoma drainage devices: part 2. Arch Ophthalmol. 2000;118(8):1081-4.

29. Wilson MR, Mendis U, Smith SD, Paliwal A. Ahmed glaucoma valve implant vs trabeculectomy in the surgical treatment of glaucoma: a randomized clinical trial. Am J Ophthalmol. 2000;130(3):267-73.

Footnotes and Financial Disclosures

Conflict of interest:

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