Original Article

# Early and Late Complications of Ahmed Glaucoma Valve Implant in a Real-World Situation

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## ABSTRACT

**Purpose:** To determine the early and late complications of Ahmed Glaucoma Valve (AGV) implant surgery.

**Study Design:** Interventional case series.

**Place and Duration of Study:** Ophthalmology department of MTI-Hayatabad Medical Complex Peshawar, from May 2018 to February 2023.

**Methods:** All the patients between May 2018 and February 2023 who underwent AGV implant were included in the study. Data included patient's age, gender, indications for surgery, type of AGV implant used, length of follow-up period, intraocular pressure (IOP), number of topical glaucoma medications used, early and late complications and the final outcome. Continuous variables (duration of follow-up, best corrected visual acuity, IOP and number of topical anti-glaucoma medications) were represented in means and standard deviations. Paired t-test was applied for comparison of means between baseline and last follow-up data. A p-value of $< 0.05$ was considered statistically significant.

**Results:** A total of 28 eyes were included. Mean age of the patients were 28.75 ± 20.5 years. Duration of follow-up was 213.96 ± 169.33 days. There were 53.85% females. Commonest indication was congenital glaucoma 7 (25%). Majority, (n= 18, 64.3%) of the eyes had previous cataract surgeries followed by glaucoma, 13 (46.4%). The commonest early post-operative complication was hyphema (25%) and commonest late complication was hypertensive episode 32.1%. Majority of the eyes 23 (82.1%) did not require any further intervention for these complications.

**Conclusion:** Majority of AGV complications are self-limiting, necessitating just conservative therapy. However, serious complications might happen that could lead to blindness, therefore the surgeons should have strategies for treating or preventing them.

**Key Words:** Glaucoma Drainage Implants, complications, glaucoma, hyphema.

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## INTRODUCTION

Glaucoma is one of the leading causes of irreversible blindness. This disease is on the rise globally as well as in Pakistan.[1] It is a major health issue and the effective way to treat and prevent further damage from glaucoma is to IOP which can be achieved by topical medications, lasers and surgeries. Sometimes, glaucoma is resistant to these therapies and requires glaucoma drainage devices.[2]

Ahmed glaucoma valve (AGV) implant is a drainage device reserved for refractory glaucoma. Although it has good results in complicated glaucoma but it is not complication free. There have been studies about the efficacy and safety of AGV in different settings but results are variable.[3–8] In a recently published study from Pakistan the authors reported the

success of AGV in refractory glaucoma.[9] However, data is lacking on its complications. Moreover, the early and late complications of AGV differ in presentation and its management. If these complications are not addressed in time, it can lead to the surgical failure and eventually worsening of glaucoma. This is why it needs to be investigated so that effective management plans can be devised. We conducted this study to determine the early and late complications of AGV implant surgery in our setup.

## METHODS

It was an interventional case series conducted at the department of Ophthalmology, MTI-Hayatabad Medical complex, Peshawar. After the ethical approval, data of the eligible patients were included through cconsecutivenon-pprobabilitysampling technique.All patients with AGV implant surgeries from May 2018 to February 2023 were included. Data included demography, indications of surgery, type of AGV, duration of follow-up, IOP, number of topical anti-glaucoma medications, early and late complications and final outcome of the procedure. All the surgeries were performed by a single surgeon (YJM). The postoperative care included topical dexamethasone 2-hourly and antibiotics eye drops 4-time a day. Cycloplegic medications were added when required for example in case of shallow anterior chamber or inflammation. The antibiotics were stopped at 2 weeks and the steroids were continued for 3 months in tapering manner. Anti-glaucoma medications were added if the IOP was raised above 21 mmHg. The follow-up schedule was day 1, week 2, month 1 and 3 and then 6 monthly, however, the schedule was modified when the complications occurred.

Information was recorded on a predesigned proforma. Early complications were defined as any complication arising with in the first four weeks (28 days) of the surgery and late complications were defined as any complication arising after four weeks (28 days) of surgery. IBM SPSS Statistics for Windows, version 24 (IBM Corp., Armonk, N.Y., USA) was used for data analysis.The categorical variables (like gender of the patient, surgery indications, model of AGV implant, early and late complications and outcome of the procedures done) were represented in frequencies and percentages. The continuous variables (duration of follow-up, best corrected visual acuity [BCVA], IOP and number of topical anti-glaucoma medications) were represented in means and standard deviations. The paired-test was applied for comparison of means between baseline and last follow-up data. A p-value of $< 0.05$ was considered statistically significant.

## RESULTS

A total of 28 eyes of 26 patients were included in this study. Mean age of the patients was 28.75 ± 20.5 years and duration of follow-up was213.96 ± 169.33 days. There were more females (n= 14, 53.85%) in the study group. The most common condition encountered was congenital glaucoma, (n=7, 25%) and FP7 model was implanted in 24 (85.7%) patients. Majority (n=18, 64.3%) of the eyes had previous cataract surgery,

**Table 1:** *Baseline demographics of study participants.*

| **Characteristics** | | **Frequency** | **Percentage** |
|---|---|---|---|
| **Age in years, mean (SD)** | **28.75 (20.5)** | | |
| **Duration of follow-up in days, mean (SD)** | **213.96 (169.33)** | | |
| **Gender (N=26)** | Female | 14 | 53.85 |
| | Male | 12 | 46.15 |
| **Laterality (n=28)** | Right Eye | 16 | 57.1 |
| | Left Eye | 12 | 42.9 |
| **Diagnosis (n=28)** | Congenital Glaucoma | 7 | 25.0 |
| | Neovascular Glaucoma | 5 | 17.9 |
| | Post Retinal Surgery Secondary Glaucoma | 4 | 14.3 |
| | Steroid Induced Glaucoma | 4 | 14.3 |
| | Secondary Glaucoma | 3 | 10.7 |
| | Uveitic Glaucoma | 2 | 7.1 |
| | Primary Angle Closure Glaucoma | 2 | 7.1 |
| | Aniridia | 1 | 3.6 |
| **AGV model(n=28)** | FP7 | 24 | 85.7 |
| | FP8 | 4 | 14.3 |
| **Implantation site (n=28)** | Anterior chamber | 24 | 85.7 |
| | Posterior chamber | 4 | 14.3 |
| **Previous ocular procedures (n=28)** | Combined Cataract& Glaucoma | 3 | 10.7 |
| | Cataract surgery alone | 18 | 64.3 |
| | Glaucoma surgery alone | 13 | 46.4 |
| | Retinal surgery | 4 | 14.3 |
| | Corneal surgery | 3 | 10.7 |
| | PRP or IVB | 5 | 17.9 |

SD=standard deviation, N=number of participants, n=number of eyes, AGV=Ahmed Glaucoma Valve, PRP=Panretinal photocoagulation, IVB=intravitreal Bevacizumab

followed by glaucoma (n = 13, 46.4%) and retinal surgeries (n=4, 14.3%). The baseline demographics of our study participants are given in table 1.

Table 2 shows the postoperative complications (early and late) of AGV implant surgeries and secondary interventions. Hyphema was the most frequent (n=7, 25%) early postoperative complication while hypertensive phase occurred in 9 (32.1%) eyes in late phase. Majority of the eyes (n= 23, 82.1%) did not require any further intervention for these complications.

**Table 2:** *Early and Late postoperative complications and secondary interventions.*

| Characteristics | | Frequency (n=28) | Percentage |
|---|---|---|---|
| **Early postoperative complications** | Hyphema | 7 | 25 |
| | Inflammation | 4 | 14.3 |
| | Tube touch | 3 | 10.7 |
| | Hypotony | 2 | 7.1 |
| | Choroidal detachment | 1 | 3.6 |
| | Hypertensive Phase | 9 | 32.1 |
| **Late postoperative complication** | Tube or Plate Exposure | 2 | 7.1 |
| | Retinal Detachment | 1 | 3.6 |
| | Tube blockage by oil | 1 | 3.6 |
| | No intervention | 23 | 82.1 |
| **Further interventions** | Patch Graft | 1 | 3.6 |
| | AGV removal | 1 | 3.6 |
| | Choroidal drainage | 1 | 3.6 |
| | Retinal detachment surgery | 1 | 3.6 |
| | Silicon oil removal | 1 | 3.6 |

n=number of eyes, AGV=Ahmed Glaucoma Valve.

**Table 3:** *Comparison of baseline and final outcome.*

| Characteristics | Baseline, Mean (SD) | Final, Mean (SD) | p-value$^{\Omega}$ |
|---|---|---|---|
| IOP (mmHg) | 35.18 (7.12) | 13.29 (5) | < 0.001 |
| Antiglaucoma medications | 3.71 (0.71) | 1.96 (0.92) | < 0.001 |

SD=standard deviation, IOP=intraocular pressure, mmHg=millimeter of mercuryΩ=paired sample t-test was used

Table 3 compares the IOP and anti-glaucoma medications between baseline and final follow-up visit which was statistically significant (p<0.001).

## DISCUSSION

The aim of this study was to determine the early and late complications of Ahmed Glaucoma Valve (AGV) implant surgery.The most common early postoperative complication was hyphema followed by inflammation and tube touching the corneal endothelium. The complications resolved with conservative management. Among the late postoperative complications, hypertensive phase was the most common followed by exposure of the tube or plate. No case of postoperative endophthalmitis was reported in our study group. Majority of the cases did not require any further intervention.

The most common early complication encountered in our study was hyphema that occurred in 25% of the cases and occurred mostly in neovascular glaucoma (NVG) cases (4/7 of all hyphema cases and 4/5 of all NVG cases). Our results are similar to that already published in literature. Arikan et al, reported 23.4% cases of hyphema in their study and all of them recovered conservatively.[10] They also reported that NVG mostly resulted in hyphema in early post-operative period. Hyphema has been reported as most frequent complication from AGV in different studies from 7% - 32.9%.[5,7,11,12] Reason of hyphema in NVG is mainly due to intraoperative bleed when inserting the tube in anterior chamber (AC). The neovessels in AC angle are fragile and bleed easily. However, this hyphema resolves by itself. In a meta-analysis, which compared different surgical approaches for NVG, it was reported that intravitreal anti-VEGF agent when combined with AGV leads to decreased rate of hyphema.[5] In an another study, frequency of postoperative hyphema was much higher (50.7%) than others in NVG secondary to proliferative diabetic retinopathy (PDR).[6] From all these studies, it is evident that hyphema is the most frequent postoperative complication especially in cases of NVG. However, this does not result in long-term complication and can be avoided with anti-VEGF treatment along with AGV.

Ocular hypertensive episode was the most common late postoperative complication found in our study. It is well recognized postoperative complication of AGV that usually presents between 4 to 8 weeks after the surgery. It has been reported to occur in 56-82% of all glaucoma implant surgeries.[13] The mechanism is believed mainly to be due to fibrosis with cyst or capsule formation around the plate that results in raised IOP. The inflammatory mediators in

aqueous are thought to be responsible for this fibrosis and subsequent restriction to aqueous flow.[14] In our study, out of 9 cases, 4 belonged to steroid induced glaucoma (SIG) group. SIG eyes are usually highly irritable and this may explain higher prevalence of hypertensive phase in our group. It has been hypothesized and tested that early treatment with aqueous suppressants may decrease the incidence of hypertensive phase in AGV cases. Pakravan et al, conducted a randomized trial to check the effect of aqueous suppressants on hypertensive phase and found that the frequency was much lower than the control group in which the conventional stepwise approach was followed (66% vs. 23.4%; $p<0.001$).[15]

We encountered 2 (7.14%)cases of late onset plate or tube exposure which is one of the dreadful complications and if not addressed can lead to further vision threatening complication like endophthalmitis. Our results are comparable to the reported cases in literature which shows 2-7.3% of cases can present with this complication.[16–18]

In this study, 5 (17.86%) eyes required further interventions for complications. All of these interventions were done for the complications that occurred in late phase. The Ahmed Baerveldt Comparison Study Group published a report of complications after 5-year follow-up and they found that their reoperation rate in AGV group was 14.3% which is similar to our results.[19,20] One patient lost vision in which retinal detachment occurred and was operated for that.

The strength of our study is that we have reported real life complications of AGV. However, the limitations are small sample size and non-comparative design of the study. It did not investigate association of these complications with the patient demographics which can be helpful in patient selection for AGV.

## CONCLUSION

Most of the complications that occur in AGV are self-limiting and only conservative treatment is require. However, dreadful complication can occur which can result in loss of vision and the surgeons should have plans for its prevention and/or treatment.

**Conflict of Interest:** Authors declared no conflict of interest.

**Ethical Approval:** The study was approved by the Institutional review board/Ethical review board **(HMC-QAD-F-00).**

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## Authors' Designation and Contribution

Saima Farooq; Registrar: *Design, Data Acquisition, Manuscript Preparation, Manuscript Editing, Manuscript Review.*

Yousaf Jamal Mahsood; Assistant Professor: *Concepts, Design, Literature Search, Data Analysis, Statistical Analysis, Manuscript Preparation, Manuscript Editing, Manuscript Review.*