Makara Journal of Health Research

Volume 22
Issue 3 *December*

Article 2

12-1-2018

Comparison of Ahmed Versus Baerveldt Implant Outcomes in Malayan Glaucoma Patients

Widya Artini
Department of Ophthalmology, Faculty of Medicine, Universitas Indonesia, Jakarta 10430, Indonesia, ikkesumantri@gmail.com

Syukri Mustafa
Department of Ophthalmology, Faculty of Medicine, Universitas Indonesia, Jakarta 10430, Indonesia

Virna D. Octariana
Department of Ophthalmology, Faculty of Medicine, Universitas Indonesia, Jakarta 10430, Indonesia

Astrianda Suryono
Department of Ophthalmology, Faculty of Medicine, Universitas Indonesia, Jakarta 10430, Indonesia

Recommended Citation
Artini W, Mustafa S, Octariana VD, Suryono A. Comparison of Ahmed Versus Baerveldt Implant Outcomes in Malayan Glaucoma Patients. Makara J Health Res. 2018;22.

Makara J. Health Res., 2018, 22(3): 115-120
doi: 10.7454/msk.v22i3.7642

Comparison of Ahmed Versus Baerveldt Implant Outcomes in Malayan Glaucoma Patients

Widya Artini*, Syukri Mustafa, Virna D Octariana, Astrianda Suryono

Department of Ophthalmology, Faculty of Medicine, Universitas Indonesia, Jakarta 10430, Indonesia

*E-mail: ikkesumantri@gmail.com

Abstract

Background: Ahmed and Baerveldt implants have already have been established for treating refractory glaucoma, however, to date, their outcome in Malayan eyes has not yet been reported. This study aimed to evaluate a comparison of the success rate between Ahmed and Baerveldt implants surgical intervention in Malayan patients with glaucoma. **Methods**: A descriptive retrospective study was conducted at Cipto Mangunkusumo Hospital, Indonesia, from January 2013 to December 2015. All glaucoma patients who underwent Ahmed and Baerveldt implants and intraocular pressure (IOP), and presented for follow-up evaluation one year post implant, were enrolled in this study. Visual acuity and complications were also recorded. A comparison between the two groups was then analysed. **Results**: The study cohort included a total of 117 glaucoma patients eyes, of which 64 and 53 received the Ahmed and Baerveldt implants, respectively. The pre-operation IOP between the two groups was found to be significantly different (p = 0.01), but no significant difference (p = 0.24) was observed after surgery, although both groups showed a declining IOP. Complete success was achieved in 75% of Ahmed and 60.38% of Baerveldt implant patients. Overall, 9 patients developed complications. **Conclusions**: Both the Ahmed and Baerveldt implant groups demonstrated similar success in reducing IOP.

Keywords: glaucoma, intraocular pressure, implant

Introduction

Glaucoma is a progressive optic neuropathy which causes associated visual field loss with increased intraocular pressure (IOP) as the main risk factor. Management of glaucoma consists of antiglaucoma medication and surgical approach, if necessary. The two common options for glaucoma surgery are conventional standard surgery of trabeculectomy, and implantation of glaucoma drainage device surgery. Glaucoma implants are commonly employed in glaucoma in management to create a bypass, thus facilitating the drainage of aqueous humour through a small tube to the subconjunctival area as far as 8 mm from the corneal limbus.[1-3] Anthony Molteno was the first person to introduce the glaucoma implant using conventional standard surgery for the treatment of glaucoma cases with a high risk of treatment failure. Since then, various types of implants are commercially available.[4]

Currently, the two implants most often utilised are the Ahmed and Baerveldt implants. The Ahmed implant uses venture-based technology with a valve that has been designed to open when the IOP is more than 18 mmHg and close when the IOP is less than 18 mmHg. This mechanism of action also minimises the possibility of post-surgical hypotonia. However, some complications such as a shallow anterior chamber, choroidal effusion and suprachoroidal bleeding may occur. The valveless Baerveldt implant requires an initial flow restriction to provide adequate time for bleb formation. Although the Baerveldt implant has been reported to cause an initial hypertensive state and fluctuating IOP, they are fewer complications of encapsulation and the necessity to administrate post-operative antiglaucoma medication. Furthermore, a more optimal controlled long-term IOP has been reported to the Ahmed implant. However, it has been proved that the Baerveldt implant may have a higher risk of hypotonia since it has no valves and has a high flow rate of aqueous humour drainage.[5-7] It should also be considered that implant success depends on the selection of appropriate candidates. Thus, it is imperative to carry out extensive identification and evaluation of patient characteristics when selecting the type of glaucoma implants to ensure a successful outcome. The global variation of patient profiles has led us to question the patient characteristics and success rate of glaucoma implants at Cipto Mangunkusumo Hospital (RSCM Kirana). The aim of this study was to evaluate a comparison of the success rate of Ahmed vs. Baerveldt implant surgery in Malayan glaucoma patients.

Methods

A descriptive retrospective study design was chosen. The study was conducted at RSCM Kirana between January 2013 and December 2015. Approval for the study was obtained from the Ethics Committee, Faculty of Medicine Universitas Indonesia (0987/UN2.F1/ETIK/2018). The inclusion criteria incor-porated all glaucoma patients who had received an Ahmed or Baerveldt glaucoma implant and whose IOP had been evaluated for one year thereafter. Patients were excluded from the study if there was incomplete data or if they failed to turn up for a follow-up visit during the year after receiving the implant. The initial patient selection was finalised according to individual glaucoma patients' medical records stored in the medical record files room at RSCM Kirana. Prior to the surgical procedure, the patients gave signed consent according to the Helsinki declaration. All important information variables were then documented in the master table. This included the patient's age at initial treatment, gender, diagnosis and clinical data such as visual acuity (logMAR), initial IOP, history of using antiglaucoma medication and laser or any eye surgeries prior to the procedure. IOP data, and glaucoma implant procedure complications were recorded and analysed at 1, 3, 6, and 12 months following the glaucoma implant procedure.

Glaucoma Implant Surgical Techniques. The surgical glaucoma implant procedure was performed at RSCM Kirana by four expert glaucoma surgeons: WA, V, SM and AS. All glaucoma implant procedures involved the installation of either a 350 mm^2 Baerveldt implant (Advanced Medical Optics, Santa Ana, CA, USA) or a 184 mm^2 single plate Ahmed implant (New World Medical, Rancho Cucamonga, CA, USA).[8,9] The procedure commenced by creating a fornix-based conjunctival incision in the supra-temporal quadrant of the eye. For both implants, placement was approximately 8–10 mm from the limbus and they were fixated at the episclera using nylon 10.0 sutures. The lateral edge of the Baerveldt implant was placed under the lateral rectus, and the medial edge was inserted under the medial rectus muscle. The tube next to the plate was tightly ligated using vicryl 7.0 sutures. Once it was confirmed that there was no water leakage into the plate a slit was made in front of the ligation for drainage of fluid.

In both surgeries, a paracentesis was made, and a viscoelastic was inserted into the anterior chamber of the eye. Next, the point of the tube was cut bevel-up approximately 2 mm long in anterior chamber close to the limbus. A guiding pathway was made using a 23 gauge needle, and the tube was directly inserted parallel to the iris towards the anterior chamber. The tube was fixated above the sclera using nylon 10.0 sutures, covered with donor sclera to prevent exposed tube and fixated on the sclera using vicryl 8.0. The exposed conjunctiva and subtenon conjunctiva were then sutured at the limbus with vicryl 8.0. After the procedure was completed, the patient was given antibiotic and steroid eye drops to be administered for two months.

The implant procedure was considered a complete success if there was a controlled IOP < 21 mmHg over two consecutive visits during the last 12-months' post-surgical follow-up, the patient did not need glaucoma medication, and the loss of visual acuity was not more than two lines of the Snellen chart. A qualified success was defined as a controlled IOP < 21 mmHg over two consecutive visits during the last 12-months' post-surgical follow-up and the use of one or more antiglaucoma medications.[10] The procedure was considered failed when the IOP > 21 mmHg. The evaluated variables were analysed using SPSS 22.0 software (IBM Corp., Armonk, NY, USA). Numerical and categorical variables were evaluated by unpaired *t*-tests and chi square tests, respectively.

Results

The patient characteristics are presented in Table 1. A total of 117 eyes from glaucoma patients were included in this study. There were 52 male patients and 106 eyes belonging to patients >30 years old. Sixty-four eyes received the Ahmed implant, and the remaining 53 eyes received the Baerveldt implant. There were 11 cases of congenital glaucoma, 15 of primary glaucoma, and 91 of secondary glaucoma. All the congenital glaucoma cases received the Ahmed implant, while the Baerveldt implant was given to 51/91 secondary glaucoma patients.

The mean IOP prior to and one year post surgery was recorded and analysed for all glaucoma implant patients. Prior to surgery a significant difference ($p = 0.01$) was

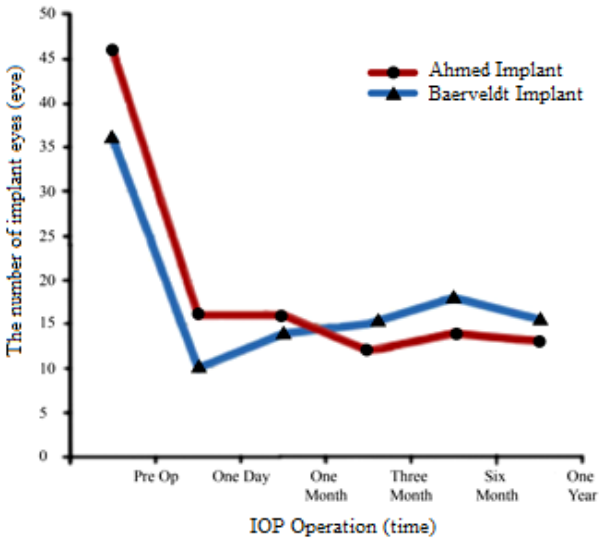

Figure 1. Intraocular pressure reduction in the ahmed and baerveldt glaucoma implant groups before surgery until one year post surgery

observed in the mean IOP of the Ahmed implant group (36.65 ± 1.30 mmHg, range 27–70 mmHg) compared to the Baerveldt implant group (46.61 ± 1.37 mmHg, range 23–70 mmHg). Furthermore, the mean IOP at one year post surgery decreased by 69.98% to 15.67 ± 1.16 mmHg in the Ahmed group and by 74.25% to 13.11 ± 4.37 mmHg in the Baerveldt group, but this was not significant (p = 0.24) (Table 2). A graph showing the IOP reduction over time is presented in Figure 1. The complete success rate of the Ahmed and Baerveldt implants was 48 (75%) and 32 (60.38%) eyes, respectively (p = 0.28). A qualified success with the Ahmed and Baerveldt implants was achieved in 6 (9.38%) and 15 (28.30%) eyes, respectively (p = 0.05). The implant procedure failed in 10 (15.63%) Ahmed implant eyes and 6 (11.32%) Baerveldt implant eyes (p = 0.72) (Table 3). Table 4 presents the comparison between the two groups regarding complications, visual acuity, and the adminis-tration of antiglaucoma medication after implant surgery. Surprisingly, only 9 patients developed complications. Moreover, patients in the Baerveldt group required more antiglaucoma drugs compared to Ahmed group. The visual acuity of both groups remained stable.

Table 1. Patient Characteristics

Variables	Ahmed Implant n = 64 eyes	Baerveldt Implant n = 53 eyes	Results n = 117 eyes
Gender			
Male	32	20	52
Female	32	33	65
Age			
<30			11
>31			106
Type of Glaucoma			
Congenital Glaucoma	11		11
Primary Glaucoma	12	3	15
Secondary Glaucoma	40	51	91

Table 2. Intraocular Pressure Comparison Before and After Glaucoma Implant Surgery

Variables	Ahmed n = 64	Baerveldt n = 53	*p*
IOP Pre Operation (mmHg)			
Mean ± SD	36.65 ± 1.30	46.61 ± 1.37	0.01*
Median ± SD	35.00 ± 1.30	46.00 ± 1.37	
Range	27–70	23–70	
IOP Post Operation (mmHg)			
Mean ± SD	15.67 ± 1.16	13.11 ± 4.34	0.24
Median ± SD	11.00 ± 1.16	12.00 ± 4.34	
% IOP reduction	69.98%	74.25%	

IOP: Intraocular pressure.
*$p < 0.05$ (unpaired t-test).

Table 3. Comparison between end results of Ahmed and Baerveldt implant surgeries

End Results	Ahmed Implant (%) n = 64	Baerveldt Implant (%) n = 53	*p*
Complete Success	48 (75%)	32 (60.38%)	0.28
Relative Success	6 (9.38%)	15 (28.30%)	0.05
Failure	10 (15.63%)	6 (11.32%)	0.72

Table 4. Comparison in complications, visual acuity, and antiglaucoma administration after Glaucoma implant surgery

	Ahmed Implant	Baerveldt Implant
Visual acuity		
Better	5	5
No change	58	45
Worse	1	3
Number of antiglaucoma medications used		
One	0	5
Two	5	9
Three	1	1
Complications		
Hyphema	0	1
Choroidal effusion	0	1
Exposed tube	1	2
Clogged tube	2	2

Discussion

The results of our study show that in most cases both the Ahmed and Baerveldt implants resulted in a satisfying IOP reduction. However, the implant devices caused vision loss in several instances, particularly in glaucoma patients with a difficult diagnosis such as neovascular glaucoma and inflammatory glaucoma. In these cases, the vision loss was not only due to the implant itself but also to the severity of the glaucoma diseases. It appears that the Ahmed implant had a higher complete success rate compared to the Baerveldt implant, but this was not statistically significant and correlates with the results of Tsai *et al*.[5] Currently, the utilisation of glaucoma implants is growing in popularity in terms of the high success rate of the surgical procedure for refractory glaucoma, especially due to better efficacy in lowering IOP over a periode of time compared to trabeculectomy with or without antimetabolites.[7,10-13] Generally, glaucoma implants are indicated for aphakic and pseudophakic glaucoma, neovascular glaucoma, post-trabeculectomy glaucoma, iridocorneal endothelial syndrome (ICE), uveitic glaucoma and post-traumatic secondary glaucoma. Moreover, glaucoma implants are also considered effective for post-keratoplasty glaucoma, secondary glaucoma after retinal procedures and paediatric glaucoma.[2,12]

Following the glaucoma implant procedure, scar tissue around the implant plate forms within a number of weeks and aqueous humour congregates in the cavity between the implant plate and adjacent tissues.[10] Subsequently, the aqueous humour passively diffuses through the capsule and is absorbed into the periocular capillaries. Fibrosis occurs in the capsule surrounding the implant plate because it has the highest resistance against aqueous humour drainage. Therefore, the magnitude of IOP reduction often depends on the thickness of the capsule and the surface area of encapsulation and the size of the implant plate. A lower IOP is expected in cases of thinner capsules with a wider surface area of encapsulation.[10]

There are various types of glaucoma implants based on implant size, form, implant plate material and the presence or absence of valves.[1,7] In Indonesia, the most commonly used implants are the Ahmed-184 and Baerveldt-350 implant. The Ahmed implant is considered the most favourable for a number of reasons; namely , this surgical procedure is less complex, a valve is used and fewer complications arise. However, its effectiveness in lowering IOP is relatively poor in cases of refractory glaucoma with a higher IOP. Therefore, surgeons tend to opt for Baerveldt implant which does not have valve. Following the procedure the Baerveldt implant group required a greater amount of additional antiglaucoma medication compared to the Ahmed implant group due to the fact that the case selection was performed for patients with a more severe glaucoma condition with a higher risks for failed trabeculectomy surgery. This study showed that initial IOP in Baerveldt implant group was higher when compare to Ahmed implant group.

The visual acuity after the implant procedures in both groups was also similar. Most patients had persistent visual acuity, and only a small percentage demonstrated improved visual acuity. Lower visual acuity was observed in both implant groups and included patients with neovascular glaucoma. This clearly demonstrates ongoing progressive retinal ischaemia despite adequate treatment, and patients with ICE syndrome, who had advanced glaucoma. These types of glaucoma are extremely difficult to manage and usually result in permanent blindness. Intra-operative complications of glaucoma implants such as bleeding, exposed tube and false insertion of the tube with subsequent leakage around the tube have been frequently reported, similar to the results obtained in our study.[5] The most common post-operative complications

in our study were tube blockage and exposed tube. Tube block is usually caused by a fibrin, vitreous or blood occlusion. All patients with a clogged tube showed improved IOP after the tube had been flushed. An exposed tube is frequently caused by mechanical injury to the conjunctiva tissue due to direct contact with the implant tube and can cause consequent erosion of the tube.

The routine use of a sclera or pericardium patch graft can lower the risk of an exposed tube by 2%–7%.[9] The development of an exposed tube frequently occurs in glaucoma implant patients with poor peribulbar conjunctiva tissue due to various previous surgical procedures such as retinal surgery.[9,11] One case of unresolved hyphema was observed within 5 days following the implant surgery. The patient sub-sequently underwent irrigation and coagulum aspiration. Thereafter, the IOP was well-controlled during the post-operative follow-up. There was also a patient with choroidal effusion within one week following surgery in the Baerveldt implant group. This was spontaneously resolved with the increased IOP. One patient in the Baerveldt implant group with neovascular glaucoma underwent an additional implant procedure.

Overall, our study has demonstrated the relatively safe utilisation of Ahmed and Baerveldt glaucoma implants with satisfying results, correlating with the results of studies in other Asian and non-Asian groups.[12-17] Previous study revealed a different pattern of wound healing between the bleb in the glaucoma implant and the bleb in trabeculectomy in Asian individuals, where the bleb on the implant was less susceptible to the response of more aggressive wound healing in Asian patients.[14] Further studies are necessary for clarification. One limitation of this study was that it was retrospective. There was also biased criteria regarding the type of implant selected, where the Baerveldt implant was used in a greater number of poor prognosis glaucoma eyes with higher IOP and in the more severe glaucoma cases, such as neovascular glaucoma. The diameter plate in the Baerveldt implant (350 mm) has a much more extensive surface area when compared to Ahmed implant plate (184 mm) and may accommodate aqueous humour in subconjunctiva area. However, our evaluation of both implant procedures indicate satisfying results and contribute to the additional benefits of glaucoma implants, particularly in the management of refractory glaucomas, such as neovascular glaucoma and glaucoma after vitrectomy surgery.

Conclusions

In conclusion, both Ahmed and Baerveldt implants have similar success rate in reducing IOP after the implant procedure. However, the Baerveldt implant group was found to require more antiglaucoma medication. Furthermore, the group was used primarily to treat glaucoma eyes with poor prognosis which have a higher risk to experience failed trabeculectomy surgery.

Funding

None

Conflict of Interest

The author report no conflict of interest.

References

1. Patel S, Pasquale LR. Glaucoma drainage device: A review of the past, present and future. *Seminars in Opthalmology*. 2010;25:265-70.
2. Minckler DS, Vendula SS, Li TJ, Mathew MC, Ayyala RS, Francis BA. Aqueous shunts for glaucoma. *Cochrane Databased Syst Rev.* 2017;28:1-50.
3. Riva I, Roberti G, Oddone F, Konstas AGP, Quaranta L. Ahmed glaucoma valve implant: Surgical technique and complications. *Clin Ophthal.* 2017;11:357-67.
4. Freedman JMS, Trope GE. Management of Glaucoma Implant Complications. In: *Glaucoma Surgery*. Boca Raton, Florida Taylor & Francis Group, 2005 p.75-82.
5. Budenz DL, Barton K, Gedde SJ, Feuer WJ, Schiffman J, Costa VP, Godfrey DG, Buys YM. Five-year treatment outcome in the Ahmed Baerveldt comparison study. *Ophthalmology.* 2015;122:308-16.
6. Aminlari AE, Scott IU, Aref AA. Glaucoma drainage implant surgery – An evidence-based update with relevance to sub-saharan Africa. *Middle East Afr J Ophthalmol.* 2013;20:120-30.
7. Resenda AF, Moster MR, Patel NS, Lee D, Dhami H, Pro MJ, Waisbourd M. Ahmed versus baerveldt glaucoma drainage implantation in patients with markedly elevated intraocular pressure (≥30 mm Hg). *J Glaucoma.* 2016:25:738-43.
8. Wang S, Gao X, Qian N. The Ahmed shunt versus the baerveldt shunt fot refractory glaucoma: A meta analysis. *BMC Ophthalmol.* 2016;16:83.
9. Mandalos A, Sung V. Glaucoma drainage device surgery in children and adults : a comparative study of outcomes and complications. *Graefes Arch Clin Exp Ophthalmol.* 2017;255:1003-11.
10. Choritz L, Koynov K, Renieri G, Barton K, Pfeiffer N, Theime H. Surface topographies of glaucomas drainage devices and their influence on human tenon fibroblast adhesion. *Invest Ophthalmol Vis Sci*. 2010;51:4047-53.
11. Oana S, Vila J. Tube Exposure Repair. *J Curr Glaucoma Pract.* 2012;6:139-42.
12. Aung T, Seah SK. Glaucoma drainage implants in Asian eyes. *Ophthalmology*. 1998;105:2117-22.
13. Goulet RJ, III, Phan AD, Cantor LB, WuDunn D. Efficacy of the Ahmed S2 glaucoma valve compared with the Baerveldt 250-mm2 glaucoma implant. *Ophthalmology.* 2008;115:1141-7.
14. Christakis PG, Kalenak JW, Zurakowski D, Tsai JC, Kammer JA, Harasymowycz PJ, *et al*. The Ahmed versus baerveldt study: one-year treatment outcomes. *Ophthalmology*. 2011;118:2172-79.

15. Koh V, Aquino CM, Chew P. Review of the ahmed versus Baerveldt study-5-year treatment outcomes. *Ann Eye Sci.* 2017;2:1-5.
16. Wang JC, See JL, Chew PT. Experience with the use of Baerveldt and Ahmed glaucoma drainage implants in an Asian population. *Ophthalmology.* 2004;111:1383-8.
17. Budenz DL, Barton K, Feuer WJ, Schiffman J, Costa VP, Godfrey DG, *et al*. Treatment outcomes in the Ahmed Baerveldt comparison study after 1 year of follow-up. *Ophthalmology.* 2011;118:443-52.