GLAUCOMA VALVE IMPLANTS IN NIGERIANS: A Report of Intermidiate Term (2 years) Experience with the Ahmed Glaucoma Valve

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SUMMARY

Objective: To describe the intermediate term (2 year) outcome of glaucoma valve implants in the management of glaucoma in Nigerians.

Design: A prospective study of three glaucoma patients who had the Ahmed glaucoma valve implant at the University of Benin Teaching Hospital and DDS Eye Surgery in Benin City.

Method and Patients: One patient had a history of failed trabeculectomy; another had refractory glaucoma from complications after cataract surgery; and a third had refractory glaucoma following blunt trauma. All had undergone Ahmed valve implantation. The pre operative and postoperative intraocular pressures were measured with the keeler non-contact tonometer and they were followed up for 24 months.

Results: The three eyes in the first 6 months postoperative period had intraocular pressure reduction in excess of the 20% benchmark reduction from the preoperative intraocular pressure and this was maintained throughout the 6-month follow-up period. The most significant complication in the short-term follow-up (1-6 months) was hypotony. Later on, the three eyes developed encapsulated blebs 8, 11 and 16 months post-surgery respectively, and one eye developed endophthalmitis. The development of encapsulated blebs made pressure control unreliable

Conclusion: This intermediate term report demonstrates that glaucoma valve implant surgery seems to be unsuitable for Nigerians because of the development of encapsulated blebs that rendered intraocular pressure control unreliable.

Key words: glaucoma, glaucoma valve implant, intraocular pressure, intermediate term, encapsulated bleb

INTRODUCTION

Glaucoma is an optic neuropathy typically characterized by visual field loss and structural damage to the optic nerve fibres with intraocular pressure as the most significant, measurable and manageable of its many risk factors. People of African descent have a higher incidence of this neuropathy than Caucasians. There have been numerous attempts to manage glaucoma outside the use of medication for control of intraocular pressure. Limbo-sclera trephination was described in 1909 by Elliot.[1] It was effective but had a lot of complications including severe hypotony. Singh introduced the micro-trephination with a diameter of 0.6mm in 1988. This cheap and simple technique had very satisfactory early term results in Nigerians[2] but the long term outcome is now uncertain. Singh's technique was, however, unsuitable for Africans because the high fibroblast activity in Africans[3] caused the fistula to obliterate in the long term. Trabeculectomy, a partial thickness filtering procedure described in 1968 by Cairns[4] is the most popular glaucoma surgery today. Trabeculectomy, however, has problems with filtering failure.[5,6] The advent of anti-metabolites improved the outcome of cases with high failure rates, but flow control, despite various adjustment procedures, remained a problem[7] leading to over-drainage and hypotony. Laser trabeculoplasty has a short affectivity period and is also less effective in persons of African descent.[8]

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Valved glaucoma implants also called glaucoma drainage devices (GDD) with the potential to regulate flow offer a greater possibility of attaining the desired eye pressures in glaucoma. The first attempt at GDD was in 1906 using a horsehair pin to drain the anterior chamber externally via a corneal paracentesis;[9] but it was in 1912 that Zorab10 used a seton device to drain the eye into the sub conjunctival space in refractory glaucoma. Early GDD procedures were designed to prevent filtration failure, but many failed because of conjunctival fibrosis.[11,12] This discovery resulted in a modification of the GDD design to include a tube and a plate; the plate provides a flow control mechanism to prevent hypotony.

GDD was initially popular in refractory glaucoma,[13] but the good outcome has resulted in their use for non refractory cases. The prominent examples of GDD today, in chronological order, include Molteno, Krupin, Baerveldt, Ahmed and Optimed. The Ahmed valve is generally acclaimed to be the most successful of the GDD in use today. This study is on the intermediate-term (2 years) experience with the Ahmed GDD implanted in three Nigerians for the treatment of glaucoma.

METHODS AND PATIENTS

The Ahmed device comprises of a silicon drainage tube and a polypropylene valve/reservoir body, which houses a silicon elastomer valve membrane. The valve/reservoir body conforms to the shape of the globe at its equator and protects the valve membrane from blockage by fibrous tissue growth.

Three patients with glaucoma were recruited into this study. One had a history of failed glaucoma filtering surgery (trabeculectomy) and was now on medication but was having problems with procuring his medications because of economic hardship. The other had refractory glaucoma from a complication of cataract surgery, lens implant and closed vitrectomy; the third patient had refractory secondary glaucoma from blunt trauma. The new procedure was clearly explained to the patients and their informed consent was obtained. The surgery was also cleared by the standing ethical committee of the University of Benin Teaching Hospital (UBTH) as the use of the Ahmed valve was a new procedure.

The patients' visual acuity (VA) was measured with the Snellen chart. Their intraocular pressures (IOP) were measured with a Keeler non-contact tonometer (Easy Eye). The cup disc ratio (CDR) was estimated with a Keeler specialist direct ophthalmoscope. Before surgery, the implant was primed with a balanced salt solution. A fornix-based conjunctival incision was made in the supero-temporal quardrant and blunt dissection lifted the tenons from the episclera creating the desired pocket.

The second patient had mitomycin C (not available at the time of the first patient) application with cotton tips in the pocket between the tenons and the episclera. The implant was fixed to the sclera 8-10 mm away from the limbus. The implant tubing was measured, trimmed and inserted into the anterior chamber (A/C) through a paracentesis performed with a 23-gauge needle at the limbus. The exposed tube was covered with a raised partial thickness scleral flap (auto graph) as we did not have donor sclera and the conjunctiva was closed with an 8/0 silk suture. Postoperatively, the patients had steroid antibiotic eye drops instilled and the eye was padded for a day or two, after which they continued on the steroid antibiotic eye drop for about 4 weeks.

Postoperatively, the IOP was measured with a Keeler non-contact tonometer weekly for the first month, then twice weekly for the next month, and then monthly. In this study, success was determined by a postoperative (post op) IOP reduction of at least 20% of pre-operative intraocular pressure.

Patient 1

Patient 1 was a 51 year-old oil worker who had advanced glaucoma. When first seen

VA	-	RE =	6/6	LE =	6/6
CDR	-	RE =	0.75	LE =	0.70
IOP	-	RE =	35mmHg	LE =	33mmHg

He was on Xalatan (a brand of latanoprost) eye drops for both eyes. The medication controlled his IOP which was in the range of 33 mmHg to about 22mmHg. However, he was layed off from his job following the crisis in the Niger Delta. He was out of job for about 6 months. It, therefore became difficult for him to purchase Xalatan, and in some instances, he could not get it to buy.

He had trabeculectomy with mitomycin in both eyes. The left eye was successful with IOP dropping from 33mmHg to 16mmHg. It has remained so. The right eye however, had a problematic postoperative period. There was delayed reformation of the A/C and we took invasive procedures such as injection of whole blood under the bleb and visco-elastic into the A/C, etc. Five months later, the filtering procedure failed because of fibrosis. The glaucoma surgery was repeated at ten o'clock. This also failed. The patient was placed on Xalatan eye drops which maintained the pressure in his eye at about 24mmHg, however, when he could no longer afford the Xalatan eye drops, we implanted the Ahmed GDD. At the time of surgery, IOP was 26mmHg (on Xalatan drops); and VA 6/9 RE. The surgery was simple and the patient very co-operative.

Patient 2

Patient 2 was a 68-year-old man who had refractory glaucoma as a complication after cataract surgery and lens implant, and later closed vitrectomy (at an eye centre in Lagos) for massive vitreous haemorrhage of two months duration.

VA - RE = HM LE = 6/12
IOP - RE = 51mmHg LE = 12mmHg
CDR - RE = poor view LE = 0.3

The patient presented with severe pain in the RE, which was also very congested. He was on active glaucoma and uveitis medications at presentation. The vigorous anti glaucoma medications were continued and the patient also had two paracenteses; these affected the intra ocular pressure little; which dropped to 43 mmHg. The patient was offered Ahmed glaucoma surgery for the refractory glaucoma. The surgery was successful and the IOP dropped satisfactorily.

Patient 3

Patient 3 was a 53-year-old civil servant who had severe blunt trauma in the right eye (RE). When seen the RE was blind (NLP) and was stony hard with IOP above 50mmHg. The VA in his left eye (LE) was 6/6, his CDR was 0.2 and IOP was 18mmHg. Repeated paracentesis in the RE did not help the patient. He had an Ahmed GDD implant, with adjunctive use of mitomycin C. This reduced the IOP satisfactorily to 13mmHg.

RESULTS

These intermediate reports present the first three eyes from three patients who had the Ahmed GDD implant at the University of Benin Teaching Hospital (UBTH) and DDS Eye Surgery Group in Benin. The follow-up period for the three eyes at the time of this report was 24 months and IOP measurement was done with the Keeler non-contact tonometer. The three eyes had very significant short-term reduction of their IOP in excess of the benchmark of 20% reduction[13] from the pre-operative IOP. However, the repeated formation of encapsulated blebs in the long term made the control of IOP unsatisfactory.

Patient 1 had a pre op IOP in the operated LE of 33mmHg. On the 3rd day post op, however, he had a very low IOP of 6-7mmHg (non contact tonometry) from over-drainage in the operated eye. A partial ligation of the tube with a 0.04mm diameter steel suture was carried out. This corrected the over-drainage and allowed the A/C to reform properly and satisfactorily. The patient had IOP measurements weekly for the first month, then twice weekly for the next month and monthly thereafter. The average IOP measurements for each month are shown in table 1. The 6-month post-op IOP for the LE was between 10mmHg and 12mmHg. No other complication was encountered. At 8 months, the patient developed an encapsulated bleb. This increased his IOP. The bleb was excised and drained, however, additional encapsulated blebs continued to reform at intervals of about three months after drainage. This became the pattern until the patient lost the eye through endophthalmitis at 21 months. The patient noticed redness and mild discomfort prior to the endophthalmitis. He thought it was due to encapsulated bleb development and planned to visit the clinic at a more convenient time for the excision and drainage when he lost vision in the eye. Despite vigorous management, vision in the eye is no light perception (NLP) and the eye mildly pthisical.

Table 1. Pre & post surgery average IOP measurements

Patient	IOP (Pre) Implant	IOP Post Implant Surgery					
		1	3	6	12	18	24
1	35	10	12	3	26 Encapsulated bleb	24	Pthisis bulbi
2	51	9	12	10	21 Encapsulated bleb	26	20
3	55	13	15	15	13 Encapsulated bleb	29	28

Patient 2 had a pre-op IOP in the operated RE of 51mmHg. The early postoperative period was uneventful. The average IOP measurements are as shown in table 1. At 6-month post op, the IOP in the LE was 13mmHg. At 11 months, the patient developed an encapsulated bleb. This was excised and drained. The blebs reformed at about three-month intervals and the patient came regularly for excision and drainage Once, he missed his appointment. He later confessed that he was advised to take his eye problem to a specialist eye centre where he was told to either continue the regular drainage or remove the implant. Patient's vision has been maintained at 6/24, but control of the IOP is no longer stable because of frequent development of encapsulated blebs.

Patient 3 had a pre-op IOP over 50mmHg and NLP vision in the RE. Postoperatively, IOP was 13mmHg. The IOP was satisfactorily controlled until he developed an encapsulated bleb 16 months later. The problem was explained to the patient and that he would require drainage of the encapsulated blebs from time to time. He visits the clinic regularly for excision drainage of the frequently reformed encapsulated blebs. The IOP is no longer satisfactorily controlled because of the encapsulated blebs.

DISCUSSION

Glaucoma is more devastating in the African for a variety of reasons. Africans have a higher failure rate after glaucoma filtering surgery because of the greater reaction to trauma[6] and more fibroblast activities.[3] All

these combine to make glaucoma management a challenge to the African ophthalmologist and the African patient. Africans are in great need of devices that can provide reliable control of IOP such as GDD offer and especially the Ahmed valve GDD which, all factors considered, is now acclaimed to be the most successful, having a success rate above 80% (table 2). In this intermediate-term report, the three cases have been followed up for 24 months.

Table 2. Comparison of the common glaucoma valves

Valve type	Molteno	Baerveldt	Ahmed
Success rate (Lowering IOP)	60.0%	72%	95%
Visual acuity (Improved or within one Snellen line)	70%	62%	82%
Hypotony (occurrence)	14.6%	76%	8%
Success rates with corneal grafts	76%	54%	84.1%

Source: Reference 15.

The three cases had successful short-term lowering of their IOP until the development of encapsulated blebs, which made IOP control less satisfactory. We cannot generalize from this small sample, likewise the follow up is still short, but others with a larger sample size and longer follow-up periods (in non-Africans) have reported success rates (reduction in IOP of more than 20% of the pre-op IOP) of about 90% for the Ahmed GDD.[15] Coleman et al. obtained a 77.9% success rate in complicated paediatric cases,[14] while Lai et al. achieved a 74% success rate in Chinese eyes with complicated glaucoma.[16] Hypotony is a recognized complication of valved GDD, although the valves were supposed to prevent this outcome. Lai et al had 10.8% cases of hypotony while Coleman et al had one case of hypotony out of 21 children with Ahmed GDD. The rate of hypotony is higher if intra operative mitomycin C is used.[7]

In this intermediate term study, only one of the three patients developed hypotony (in the immediate post-op period) which we acted quickly to control by partial ligation of the tube with a steel suture. This occurred in the only patient that did not have adjunctive use of mytomycin C intra-operatively.

The formation of encapsulated blebs is a problem with GDD, including Ahmed, if anti metabolites are not used in the surgery. Lai et al. suggest that encapsulated bleb is the commonest complication of post GDD implant with a rate of 24.6% after a variable follow up of 6 months to 37 months in a series of 65 eyes. However, Kook et al., in a series of 40 eyes, had no cases of encapsulated bleb[17] when mitomycin C was used intraoperatively, but had much higher cases of hypotony, shallow A/C and other complications associated with mitomycin C use intraoperatively (table 3).

Table 3. Brief comparison of adjunctive mitomycin C and non mitomycin

Complications	Mitomycin C (40)[17]	Non-mitomycin C (65)[16]
Encapsulated bleb	Nil	(16) 24.6%
Hypotony	7 (17.5)	(7) 10.8
Hyphaema	(5) 12.5	(9) 13.9
Choroidal detachment	(5) 12.5	(7) 10.8
Tube obstruction	(5) 12.5	(4) 6.2

In this study, all three patients developed encapsulated blebs in spite of the fact that two of them had intraoperative adjunctive use of mitomycin C. Mitomycin C was not used on the first patient but he had a repeat trabeculectomy in the eye. The encapsulated bleb in this eye developed by the 8th month, and recurred every 10-12 weeks. The second patient did not have a trabeculectomy, but had cataract surgery and later closed vitrectomy. The first encapsulated bleb developed 11 months after the initial GDD implant surgery. The third patient had no history of previous eye surgery, but he had a blunt eye injury that resulted in refractory glaucoma. He developed an encapsulated bleb 16 months later. In each patient, the blebs reformed at about 3 monthly intervals. We were unable to find any studies on the frequency of occurrence of encapsulated blebs after surgery in African eyes. Dr. Ahmed, the inventor of the Ahmed valve, when contacted on the problems of encapsulated blebs in African eyes, advised that the implant, with or without adjunctive use of mitomycin C, should be suspended for now because of the unrelenting high fibroblast activity causing encapsulated blebs in African eyes. We had thought that antimetabolites, such as mitomycin C, that have improved the success rate of filtering procedures such as trabeculectomy, would allow the African patient to reap the benefit offered by GDD implants in the management of glaucomas. Unfortunately, the GDD, as foreign bodies, provoke a great deal of fibroblast activity in Africans, causing encapsulated blebs.

In conclusion, the GDD seem presently unsuitable for Africans, including Nigerians, in the intermediate and long terms because of the high fibroblast activity elicited by the GDD, causing encapsulated blebs for which there seems to be no solution for now.

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