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INITIAL CLINICAL EXPERIENCE WITH AHMED VALVE IMPLANTATION IN REFRACTORY PEDIATRIC GLAUCOMA

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SUMMARY – The purpose is to report on the safety and efficacy of Ahmed Glaucoma Valve (AGV, New World Medical, Inc., Rancho Cucamonga, CA, USA) implantation for the management of refractory pediatric glaucoma observed during one-year follow up period. A retrospective chart review was conducted on 10 eyes, all younger than 11 years, with pediatric glaucoma that underwent AGV implantation for medicamentously uncontrolled intraocular pressure (IOP) between 2010 and 2014. Outcome measures were control of IOP below 23 mm Hg (with or without antiglaucoma medications) and changes in visual acuity. Complications were recorded. After AGV implantation, IOP values ranged from 18 mm Hg to 23 mm Hg (except for one eye with postoperative hypotonia due to suprachoroid hemorrhage, where the postoperative IOP value was 4 mm Hg). The number of antiglaucoma medications was reduced, i.e. four patients had two medications, one patient had one medication, and the others did not need antiglaucoma medication on the last follow-up visit. One eye had suprachoroid hemorrhage, one eye had long-term persistent uveitic membrane, and two eyes had tube-cornea touch. In conclusion, AGV implantation appears to be a viable option for the management of refractory pediatric glaucoma and shows success in IOP control. However, there was a relatively high complication rate limiting the overall success rate.

Key words: *Ahmed Glaucoma Valve; Glaucoma, pediatric; Intraocular pressure, medicamentously uncontrolled; Glaucoma – surgery*

Introduction

Pediatric glaucoma is a potentially blinding disease, which is often refractory to medical treatment. Although traditional surgical procedures for the management of pediatric glaucoma, such as goniotomy, trabeculotomy, and combined trabeculotomy and trabeculectomy have high success rates when performed as initial surgical procedures[1,2], many of the children with pediatric glaucoma will require other forms of surgical therapy to achieve adequate control of intraocular pressure (IOP). Some of the more refractory secondary pediatric glaucomas, such as those associated with anterior segment dysgenesis, aniridia, Sturge-Weber syndrome, and following congenital cataract surgery, show poor results using these surgical approaches[3,4].

Glaucoma drainage devices have become popular in the management of these glaucomas. The Molteno, Ahmed and Baerveldt implants are currently the most popular implants used in the management of refractory glaucoma.

The purpose of this study was to evaluate the efficacy of the Ahmed Glaucoma Valve implant (AGV, New World Medical Inc., Rancho Cucamonga, CA, USA) in pediatric patients with refractory glaucoma

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related to IOP control, changes in visual acuity, and complications during one-year follow up period.

Subjects and Methods

A retrospective chart review was conducted on 10 eyes in nine consecutive pediatric patients with refractory glaucoma treated with AGV implantation from 2010 to 2014 at the Clinical Department of Ophthalmology, Sestre milosrdnice University Hospital Center, Zagreb, Croatia. There were six boys and four girls, all younger than 11 years. The retrospective review of patient charts for this study was approved by the Hospital Ethics Board. All surgeries were performed by the same surgeon (Z.M.), who was also present at all follow up examinations.

There were 4 eyes with secondary aphakic glaucoma, 3 eyes were pseudophakic with uncontrolled IOP, 1 eye had secondary uveitic glaucoma, and 2 eyes had primary congenital glaucoma.

Combined trabeculotomy with trabeculectomy procedure was previously performed in each eye, and trabeculectomy with trabeculotomy at 6 o'clock position was also previously performed in 2 eyes. All study subjects had uncontrolled IOP, which means more than 21 mm Hg despite maximal medical therapy (≥3 topical antiglaucoma medications).

Surgery was performed under general anesthesia in all eyes using the S-3 model (pediatric size of AGV). The implant was placed in the superior-temporal quadrant in all eyes except for one eye where it was placed in the supero-nasal quadrant, at a distance of 8-10 mm from the limbus. Then scleral flap was formed to cover the external surface of the tube. The tube was inserted into the anterior chamber, after being primed with balanced salt solution, using a 23 gauge needle, parallel to the iris surface, into the ciliary sulcus. The tube was fixed to the sclera using 10-0 nylon suture and conjunctiva was repositioned and sutured.

In the immediate postoperative period, patients received topical atropine combined with topical corticosteroids and antibiotic preparations that were tapered slowly over a 4-week period.

Each patient was reviewed within the week before surgery and daily for the first 5 postoperative days at a minimum. After that, patients were examined 3 to 4 weeks after surgery and at various intervals thereafter until the final visit, with minimum follow up of 1 year. Intraocular pressure was measured awake using Goldmann applanation tonometer or under general anesthesia when patients were uncooperative for evaluation. Perkins tonometer was only used for examinations under anesthesia.

Complete success was defined as IOP between 6 mm Hg and 21 mm Hg without medications and no loss of vision due to complications such as choroid hemorrhage or phthisis during the follow up period. Qualified success included cases in which the above criteria were fulfilled with the addition of glaucoma medications. Failures were defined as IOP <6 mm Hg or >18 mm Hg, loss of light perception, loss of vision due to complications, removal of the implant or the need for further surgical intervention for IOP control including cyclodestructive procedures.

The following data were extracted from medical records: age, sex, type of glaucoma, visual acuity measurements when available (before and after surgery), details of slit lamp examination or under the operating microscope (before and after surgery), IOP measurement obtained with Perkins or Goldmann applanation tonometry (before and after surgery), optic disk and fundus evaluation, and axial length measurements when available (before and after surgery). The number of topical antiglaucoma medications before and after surgery, was also noted in medical records. Details of surgeries performed prior to AGV implantation were noted. Operative details included the model of the implant used, the quadrant in which it was placed, and intraoperative surgical complications, if any. Postoperative details included visual acuity, IOP measurements, number of medications, complications, and additional interventions in the postoperative period.

Results

Table 1 summarizes data recorded in the study. There were 4 eyes with secondary aphakic glaucoma, 3 eyes were pseudophakic with uncontrolled IOP, 1 eye had secondary uveitic glaucoma, and 2 eyes had primary congenital glaucoma (1P, 2P). Visual acuity was the same before and at the end of follow up period. IOP values before AGV implantation ranged from 25 mm Hg to 38 mm Hg despite maximal medical therapy. After AGV implantation, IOP values were from 18 mm Hg to 23 mm Hg (except for 1 eye with postoperative hypotonia due to suprachoroid hemorrhage,

Table 1. Postoperative patient data

Eye no.	Visual acuity	IOP (mm Hg)	No. of medications	Complications	Intervention	Final outcome
1 P	0.15150.15	30/22	2	None	Cyclodestruction	Failure
2 P	0.15	29/23	2	None	Cyclodestruction	Failure
3	0.15	26/18	0	None	None	Success
4	0.075	28/20	1	None	None	Success
5	0.075	25/20	0	None	None	Success
6	L+P+	35/21	2	Tube-cornea touch	Cyclodestruction	Failure
7	L+P-	34/23	2	Tube-cornea touch	None	Failure
8	Lost eye	37/4	0	Suprachoroid hemorrhage	None	Failure
9	0.15	38/21	0	None – early hyphema	None	Success
10	L+P+	32/21	2	Uveitic membrane	None	Success

IOP = intraocular pressure; P = primary congenital glaucoma

where the postoperative IOP value was 4 mm Hg). The number of antiglaucoma medications was reduced in postoperative period, i.e. four patients had two medications, one patient had one antiglaucoma medication, and the others did not need antiglaucoma medication on the last follow-up visit. Table 1 also shows final outcome where success was defined as IOP <21 mm Hg and the success rate was 50%. Figure 1 shows normal postoperative finding after AGV implantation.

In our study, only one eye had a flat anterior chamber and hypotonia secondary to suprachoroid hemorrhage. The preoperative IOP in this eye was 37 mm Hg, and postoperative hypotonia was 4 mm Hg (previously mentioned patient) (Table 1, Fig. 2). There were two patients with tube-cornea contact (Table 1, Fig. 3). This occurred early in our case series and the rate of tube contact has since been reduced by modifying surgical protocol to place the tube more posteriorly in the anterior chamber. The tube contact tended to occur in buphthalmic eyes of very young patients, perhaps because of the reduced scleral rigidity and anterior migration of the anterior chamber tube with postoperative pressure reduction, which allowed shrinkage of the stretched sclera and globe[5].

One patient had uveitic membrane in the early postoperative period, which resolved after two months (Fig. 4), and one patient had hyphema, which resolved during the first postoperative week (Fig. 5).

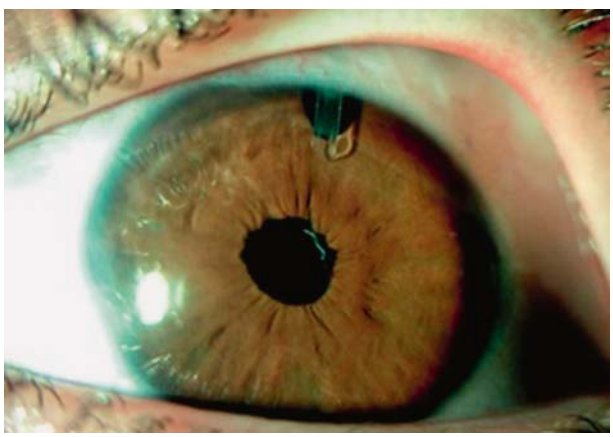

Fig. 1. Normal postoperative finding with visible tube in anterior chamber.

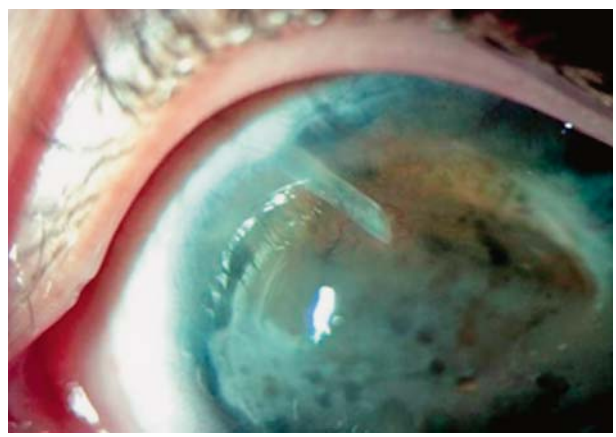

Fig. 2. Flat anterior chamber secondary to suprachoroid hemorrhage.

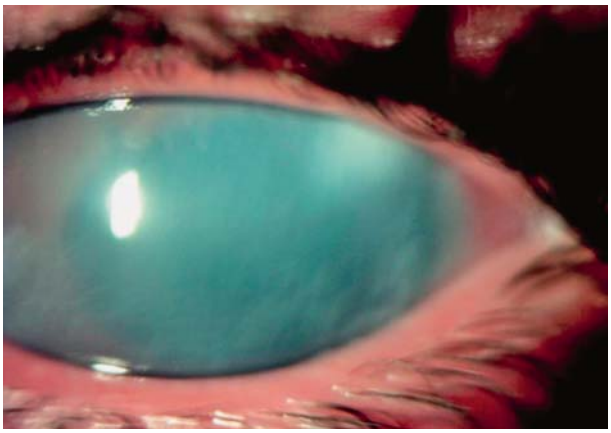

Fig. 3. Tube-cornea contact (whitish area on superotemporal cornea).

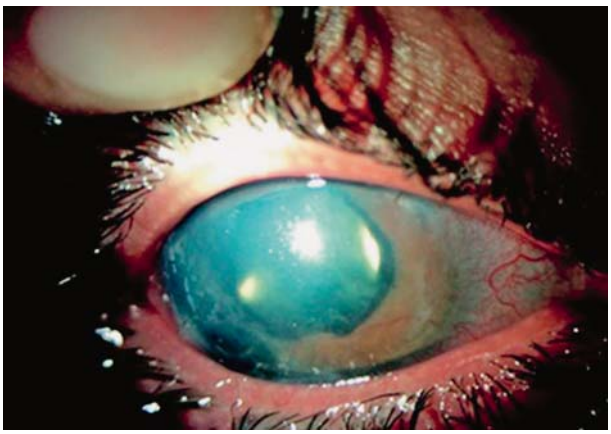

Fig. 4. Uveitic membrane in pseudophakic eye with glaucoma.

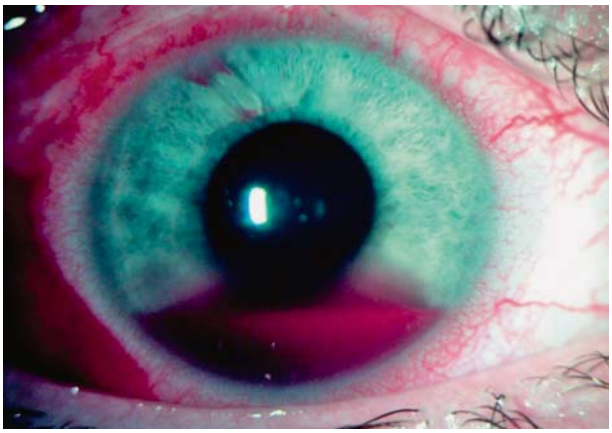

Fig. 5. Postoperative hyphema.

Discussion

Glaucoma drainage implants are useful when other surgical treatments have a poor prognosis for success, prior conventional surgery fails, or when significant conjunctival scarring precludes filtration surgery. Studies of glaucoma drainage implants in pediatric patients report success rate ranging from 56% to 95%, depending on patient age, type of glaucoma, variations in the definition of success, and length of follow up[6-10]. However, complications have been associated with drainage implants in pediatric patients. Reported complications include hypotonia with flat anterior chamber and choroid detachment, tube-cornea touch and corneal edema, obstructed tube, exposed tube or plate, endophthalmitis, and retinal detachment. Postoperatively, patients often require adjunctive glaucoma medications[5]. In the study, we had one patient with flat anterior chamber due to suprachoroid hemorrhage and none of the other eyes had shallow or flat anterior chamber that required reformation during the study. Shallow or flat anterior chambers can be difficult to manage in pediatric patients, and additional anesthesia is often necessary. Also, we had two patients with tube-cornea contact due to postoperative tube migration (typically anteriorly). Other studies report this complication in 26% to 35% of patients[11-13]. This phenomenon is more likely in the elastic infant eye than in the older child or adult[5]. In the present study, there were no other complications.

The World Glaucoma Association guidelines for reporting success rates following glaucoma surgical procedures recommend several alternatives for the upper limit (<21 mm Hg, 18 mm Hg, 15 mm Hg and 12 mm Hg), and one for the lower limit (6 mm Hg)[14]. Most reports on the use of AGV in pediatric eyes use an upper limit of 21 mm Hg to 23 mm Hg and lower limit of <5 mm Hg with or without medications to define success, and report success rates of 70% to 94% using these definitions[15]. In our series, 50% of the eyes had successful control of IOP at the final visit using these definitions. Although these patients required adjunctive glaucoma medications to achieve satisfactory IOP, they had no need for additional surgical intervention during the one-year follow up period.

Our study had the limitations of retrospective design, mixture of preoperative diagnoses, and a relatively small sample size. Collected data were limited to those that were available in medical records.

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Sažetak

POČETNO KLINIČKO ISKUSTVO S IMPLANTACIJOM AHMEDOVE GLAUKOMSKE VALVULE KOD REFRAKTORNOG GLAUKOMA DJEČJE DOBI

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Svrha rada je prikazati sigurnost i učinkovitost implantacije Ahmedove glaukomske valvule (AGV, New World Medical, Inc., Rancho Cucamonga, CA, SAD) kod refraktornog glaukoma dječje dobi tijekom jednogodišnjeg praćenja. Proveden je retrospektivni pregled nalaza 10 očiju u djece mlađe od 11 godina u kojih je ugrađena AGV zbog medikamentima nekontroliranog glaukoma u razdoblju od 2010. do 2014. godine. Pratila se visina intraokularnog tlaka (IOT) i vidna oštrina, a također su bilježene komplikacije. Rezultati su pokazali da su nakon implantacije AGV vrijednosti IOT-a bile od 18 mm Hg do 23 mm Hg (osim kod jednog oka s poslijeoperacijskom hipotonijom zbog suprakoroidnog krvarenja, gdje je poslijeoperacijski IOT bio 4 mm Hg). Broj antiglaukomskih lijekova bio je smanjen: četvoro bolesnika su imali po dva lijeka, jedan je imao jedan lijek, a svi ostali nisu trebali dodatne lijekove na posljednjem pregledu. Kod jednog oka se pojavilo suprakoroidno krvarenje, kod jednog dugotrajna upalna membrana, a kod dva oka kontakt cjevčice s rožnicom. Zaključuje se da implantacija AGV predstavlja izbor u liječenju refraktornog glaukoma dječje dobi i ima uspjeha u kontroli IOT-a. Međutim, relativno velik broj komplikacija ograničava konačan uspjeh.

Ključne riječi: *Ahmedova glaukomska valvula; Glaukom, dječja dob; Intraokularni tlak, medikamentno nekontroliran; Glaukom – kirurgija*