Original Article

Post-Operative Implant Exposure After Ahmed Glaucoma Valve Implantation: A Case Series

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Abstract

Background: This study aimed to describe the prevalence, risk factors, clinical presentation, management, and outcomes of post-operative Ahmed glaucoma valve (AGV) tube exposure in patients with a history of glaucoma drainage devices presenting to the Imam Hossein Hospital, Iran.
Material and Methods: In this retrospective case series, patients' records with the diagnosis of glaucoma drainage device exposure were reviewed. Records of eight eyes of eight patients (three males, five females) were examined. The primary outcome of this study was a management technique for glaucoma drainage device exposure.
Results: All patients suffered post-operative implant exposure after Ahmed glaucoma valve implantation for uncontrolled glaucoma. Most patients underwent subsequent glaucoma drainage device placement plus conjunctival graft, and three performed cyclodestructive procedures to control their glaucoma.
Conclusions: Based on the results, the history of past ocular procedures for glaucoma drainage device exposure and poor outcomes following repair in this subset of patients is essential.

Keywords: Ahmed Glaucoma Valve; Exposure; Glaucoma.

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Introduction

Recently, Glaucoma drainage devices (GDD) have been widely used, decreasing the trabeculectomy surgery rate for glaucoma patients, but these procedures include multiple risks, including device exposure and subsequent devastating complications, like endophthalmitis.[1]the first drainage device implanted into an eye

The device exposure rate varies between 0 to 12 % depending on studies. Multiple risk factors, including female sex, younger or older age, implant location, prior inflammation or surgeries, and combined surgeries, have been described with considerable rates of plate or tube exposures [1,2,3] .

GDD exposure can be managed using conjunctival, scleral, or pericardial patch grafts or amniotic membrane transplant, device removal, new device implantation, or intraocular pressure controlling using medications or other surgeries, such as cyclodestructive procedures.

Previous studies have reported poor outcomes and the need for multiple reoperations for this subset of patients [2] past ocular history, pre-operative and post-operative information including the surgical technique of GDD surgery and exposure repair were recorded. The patients were followed for further exposure to the date of the last follow-up clinic visit. For each type of repair technique, details were collected on risk and timing of GDD exposure. The baseline features of eyes that had further exposure after initial exposure were compared to eyes without further exposure. Results: Forty-three eyes were identified which had repair after an initial exposure. The mean ± SD age was 54 ± 27 years. Of the GDDs, Ahmed FP7 was performed in 31 eyes, Ahmed FP8 in two eyes, Ahmed S2 in five eyes, Krupin valve in two eyes and Baerveldt 350 GDD in three eyes. The methods of repair and the relative risk [95 % CI] of re-exposure were: conjunctival closure only (n=4; RR=2.10 [0.84–5.23], [4] an elbow exposure, and 1 unknown complication. Forty eyes were followed for evidence of additional aqueous shunt exposures or additional surgical interventions for 46.6 weeks (40.2 wk.

In this retrospective case series study, eight patients described who presented to the glaucoma clinic at the Imam Hossein Hospital, Iran, to discuss the prevalence, risk factors, and management of this subtype of patients.

Material and Methods

Surgical records of patients with glaucoma drainage device exposure history were reviewed at the Imam Hossein Hospital in 2015-2022.

Eight eyes were found from eight patients with a history of Ahmed glaucoma valve (AGV) placement.

The patients were operated on by a single attending surgeon using a 23G needle-making shelved incision and a partial thickness scleral flap. The tubes were placed in the anterior chamber parallel to the iris and away from the corneal endothelium.

The risk factors included age, sex, type of glaucoma, number and type of previous ocular surgeries, primary vs. secondary GDD implantation, quadrant of GDD implantation, and past medical history of systemic disorders.

Case Reports

Case 1: A 51-year-old man who had trabeculectomy diagnosed with ICE underwent AGV surgery three years after a failed trabeculectomy. Then, the patient performed phacoemulsification and underwent DSAEK surgery. Penetrating keratoplasty (PKP) was conducted due to a

Table 1: Patients' characteristics

Patient number	Age	Eye	Sex	Pre-operative Visual Acuity	Time to Exposure	Glaucoma Type	Previous Surgeries	Systemic Disorder
1	51	OS	M	2mfc	2 years	Iridocorneal endothelial syndrome (ICE)	Trabeculectomy, Phacoemulsification, DSAEK[1], PKP	-
2	56	OS	F	2/10	1 year	Primary open-angle glaucoma (POAG)	Trabeculectomy	Diabetes mellitus, Hypertension, Colon cancer
3	27	OD	M	7/10	1 month	Post vitrectomy	Phakic Artisan, Vitrectomy	-
4	60	OD	M	8/10	1 year	Primary open-angle glaucoma	Trabeculectomy	-
5	65	OS	F	5/10	2 years	Chronic angle closure glaucoma (CACG)	Trabeculectomy, Phacoemulsification	-
6	10	OD	F	1mfc	3 months	APHAKIC GLAUCOMA	Phacoemulsification, AGV	-
7	70	OS	F	1mfc	4 years	Primary open-angle glaucoma	Phacoemulsification	-
8	35	0D	F	1/10	2 months	Neovascular glaucoma (NVG)	Phacoemulsification, AGV	Type I Diabetes mellitus

1-Descemet stripping endothelial keratoplasty

failed DSAEK graft. On follow-up, the tube was about 1 mm exposed without leakage. The patient was treated with Timolol/Dorzolamide combination plus Brimonidine, Latanoprost, and Fluorometholone eye drops. During the reparative surgery, the tube was removed due to a significant defect and the potential re-exposure risk, and a new tube was placed in the supranasal quadrant. The patient did not experience any new complications until the last follow-up (two years after the previous surgery).

Case 2: The second patient was a 56-year-old woman with a history of diabetes mellitus, hypertension, colorectal cancer, chemotherapy, and POAG who underwent phacoemulsification and AGV surgery due to failed trabeculectomy. The AGV tube was exposed about two weeks after surgery. The repair was done, but tube exposure persisted, resulting in tube removal and subsequent cyclodestructive procedure. The IOP[1] remained controlled with topical medication

1. Intraocular pressure

after the last procedure, but scleral exposure remained until the last visit.

Case 3: The third patient was a 27-year-old man with a history of phakic artisan surgery and vitrectomy due to retinal detachment. He underwent AGV due to secondary glaucoma, and his tube was exposed without any evidence of leakage about one month later. He was using topical betamethasone at the time of exposure. Then, the repair was performed using a conjunctival graft, and the patient was fine without needing another procedure.

Case 4: The fourth patient was a 60-year-old man with a history of POAG and phacoemulsification who underwent AGV surgery due to failed trabeculectomy. The tube was exposed about two months later with evidence of leakage. Then, the repair was done using a conjunctival graft, but re-exposure occurred after two months, and the AGV tube was transferred to another site under healthy conjunctiva. Then, re-exposure occurred for the third time two years after the last procedure, which resulted in device removal. The patient's IOP was controlled using Timolol/Dorzolamide combination and Brimonidine and Latanoprost eye drops. The patient had a history of using Betamethasone, lubricating eyedrops, and ointments between procedures.

Case 5: The fifth patient was a 65 years old woman with a history of trabeculectomy due to POAG. AGV was placed due to failed trabeculectomy, but tube exposure happened one month after surgery. The patient's AGV was removed due to the absence of healthy conjunctiva, and a cyclo-destructive procedure was done. The patient's IOP was under control using Timolol/Dorzolamide combination and Brimonidine eye drops.

Case 6: A 10-year-old child with secondary glaucoma due to congenital cataract surgery at the age of one, who underwent the first AGV in the supra temporal region at the age of seven and second AGV in the supranasal region due to increased IOP about two years later. The second tube was exposed after three months, AGV was removed, and a cyclo-destructive procedure was done for the patient due to the large size of exposure. Healthy conjunctiva was saved for probable future procedures in adulthood.

Case 7: The seventh patient was 70 years old aphakic woman who underwent AGV for uncontrolled IOP with medication. She had tube exposure about two years after surgery without any signs of leakage. No repair was done due to the patient's lack of consent for a reparative operation. The lubricant eyedrops and ointments were prescribed, the patient had no sign of infection during follow-up (up to 2 years), and her exposure size remained stable.

Case 8: The last patient was a 35 years old woman with a history of Type I diabetes mellitus who underwent AGV surgery in the supratemporal quadrant due to neovascular glaucoma. She underwent repair surgery with a conjunctival graft for tube exposure and simultaneous placement of the second tube in the supranasal quadrant. The AGV in the supratemporal quadrant was exposed about three days after the last operation. Her conjunctival graft was retracted, removing the tube in the supratemporal quadrant. About one month after this procedure, she experienced tube exposure in the supranasal tube with an adjacent area of scleral melting (34mm) and two sites of uveal exposure (0.5mm) 2mm away from the limbus. Considering multiple surgical procedures and a history of unsuccessful reparative procedures, she was prescribed antibiotic and erythropoietin eye drops four times a day and lubricating eye drops with the resulting repair of this small tube exposure

and conjunctivalization of the melting area. Erythropoietin drops were made by diluting 1.5mL of recombinant human erythropoietin solution for intravenous use (10,000IU/0.5mL; Pooyesh Darou Biopharmaceutical Co., Tehran, Iran) with 8.5mL of normal saline to arrive at a concentration of 3000IU/ML. After one month, the patient experienced a more significant exposure event with erythropoietin, which led to repair surgery with a tube displacement far from the injured conjunctiva, then continued with a lubricant, which was good until one year of follow-up.

Results

The median age of our patients was 53.50 years, with an interquartile distance of 34.75. Three patients were male (37.5 %), and five were female (62.5 %). Six of our patients had no remarkable history of systemic disorders. However, two patients (25 %) had a history of diabetes mellitus, and one had a history of HTN and colorectal cancer treated by chemotherapy. Three patients (37.5 %) were diagnosed as POAG, one as CACG, one as ICE syndrome, one as NVG, one as aphakic glaucoma, and one had glaucoma secondary to vitreoretinal surgery.

Five of the patients experienced previous Phacoemulsification surgery, four of the patients (50 %) had previous trabeculectomy, two (25 %) had prior AGV implantation, one had a history of DSEK surgery and subsequent penetrating keratoplasty, and one had a history of last phakic artisan and vitreoretinal surgery. Six patients (75 %) had their primary GDD surgery, and two (25 %) had a history of previous GDD implantation.

About five (62.5 %) patients required tube removal, one of which occurred after a conjunctival graft. Two patients needed subsequent cyclodestructive surgery, and one had new AGV implantation. One patient's exposure remained controlled after conjunctival autograft, and another's exposure healed after treatment with erythropoietin drops. One of the patients had no reparative operation due to a lack of consent for surgery, but her exposure size remained stable, and no episode of infection had been diagnosed in this patient.

Discussion

The patients were in a broad age range, showing that exposure can occur regardless of age range. The patient sample was too small to conclude any sex predilection for glaucoma drainage device exposure. However, Al-Beishiri et al. and Muir et al. detected female sex and older age as risk factors for GDD exposure. Chaku et al. reported older age and previous history of ocular inflammation as a risk factors for GDD exposure [7]respectively; P=0.003.

The studied patients did not have significant common comorbidity except for one case of diabetes and one case of colorectal cancer. Other workups for autoimmune and malignant diseases were negative in these patients. Byun et al. and Muir et al. did not identify hypertension and diabetes mellitus as risk factors for GDD exposure [8].

The studied patients had a history of a broad spectrum of glaucoma causes covering most types of glaucoma etiologies, deducing that glaucoma drainage device exposure is not limited to a specific subtype of glaucoma etiology. However, Trubnik et al. identified pseudo-exfoliation glaucoma as a significant risk factor for GDD exposure. Other identified risk factors in the mentioned study were smoking, prolonged surgery time, and a history of dry eye [9].

The experience with time to exposure after

AGV placement was between 1 to 48 months, which was in accordance with previous reports. In Levinson et al., the average time to exposure was 25 ± 21.3 months. The only risk factor identified in this study was the inferior placement of the GDD [1]the first drainage device implanted into an eye. The mean time to exposure was 17.2 ± 18 months[7]respectively; P=0.003 in Chaku et al. and 21.5 months in Huddleston et al.[4]an elbow exposure, and 1 unknown complication. Forty eyes were followed for evidence of additional aqueous shunt exposures or additional surgical interventions for 46.6 weeks (40.2 wk The mean time to exposure in Muir et al. was 25 ± 19 months. Al-Beishiri et al. reported a mean time to exposure of 50 months, which seems to be longer than the times noted in the other studies.

Prior history of ocular surgeries was a common risk factor in the patients, most of whom were under corticosteroid eyedrops before tube exposure. Like other reports, the prognosis was poor in the patients with glaucoma drainage device exposure, which aligns with Byun et al. and Al-Beishiri et al., who reported several prior ocular surgeries as a significant risk factor for GDD exposure.

Re-exposure occurred in many patients, resulting in multiple operations, including removal of the device, conjunctival graft, implantation of a new device, and aggressive procedures such as cyclodestruction. However, reprocessing was limited to the aged patients, and younger patients seemed to have a better prognosis for reoperation, proposing age as a potential risk factor for reoperation failure. Huddleston et al. reported black race, number of antiglaucoma medications, and history of laser or combined glaucoma surgery as risk factors for reoperation after the first repair.

The last patient was managed nonoperatively using erythropoietin drops, which was in concordance with Feizi et al. regarding the uses of erythropoietin drops in various ocular disorders. Additional studies are required in this subset of patients to clarify the effectiveness and safety of this treatment modality [10].

Conclusion

Glaucoma drainage device exposure is a severe complication with a poor prognosis, and prior ocular surgeries should be considered a significant risk factor for this complication. Management includes procedures like conjunctival, pericardial, or scleral patch graft, tube reimplantation, AGV removal, and cyclodestructive procedures. The tube redirection far from the injured conjunctival area with adequate lubrication probably appears to be the best method for preventing tube re-exposure. Only one case was treated with erythropoietin drops. Additional controlled trials are suggested to clarify the effectiveness of erythropoietin drops.

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Footnotes and Financial Disclosures

Conflict of interest:

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