

Case Report

DIPLOPIA POST GLAUCOMA DRAINAGE DEVICE (GDD): A CASE SERIES

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ABSTRACT

Diplopia is one of complications of glaucoma treatment especially patient treated with glaucoma drainage device (GDD) due to restrictions of the ocular motility. We reported a series of three cases who developed diplopia following GDD surgery. Case 1, a 46-year-old man who had right eye Baerveldt done in February 2021 after previous 2 trabeculectomies failed. Case 2, a 38-year-old man, a case of bilateral pseudophakic glaucoma. who had bilateral Ahmad glaucoma valve implant 19 years prior. Case 3, a 34-year-old lady who underwent right eye Ahmed glaucoma valve implant in 2004 for congenital glaucoma. All cases developed ocular motility problem and diplopia post operatively. Diplopia is an important complications of glaucoma drainage device which affect the patients with existing restricted visual function. It is important to counsel patients on the occurrence of diplopia associated with GDD surgery.

INTRODUCTION

Glaucoma that is refractory to medical therapy or secondary glaucoma are treated with glaucoma drainage device (GDD) such as Baerveldt Glaucoma Implant (BGI) and Ahmed Glaucoma valve (AGV) [1]. Strabismus, motility disturbance and diplopia have been reported after GDD implantation [2]. The development of diplopia after surgery is significant particularly in patient with good binocular visual acuity, affecting the patient's daily activity and health-related quality of life and [3].

CASE PRESENTATION

Case 1

A 45-year-old gentleman has bilateral secondary chronic angle closure glaucoma (CACG), following an acute episode of bilateral anterior uveitis when he was young. Left Baerveldt GDD implantation was done in February 2021 after previous failed Xen glaucoma stent and 2 augmented trabeculectomies. His left trabeculectomy done in 2006 however is draining well but with a large cystic bleb superiorly. Patient complained of diplopia 2 months after the GDD surgery. He has limited up gaze and diplopia in primary and up gaze. He has good central vision in both eyes with visual acuity of 6/24 and 6/6 in the right and left eye respectively. The Baerveldt GDD is

functioning well however the diplopia affects his daily activity and give him headache and dizziness.

Orthoptic assessment revealed right hypertropia of 25 prism diopters, too high for correction with prism. Surgical correction is not recommended due to unstable fusion as well as too challenging. Patient only has limited binocular single vision inferiorly and has to move about cautiously.

Case 2

A 38-year-old gentleman has bilateral developmental cataract, bilateral lens aspiration with intraocular lens implantation was done when he was 10 years old. Six years post operatively he developed pseudo-phakic glaucoma. He had Ahmed GDD implantation done as a primary surgery in both eyes. The GDD was placed superior nasally in both eyes, the recommended location of the reservoir then. Within 2 months after the surgery the patient developed convergence insufficiency with symptoms of headache, blurring of vision and occasional diplopia. Later he had vertical binocular diplopia. He has right hypotropia at primary gaze and right restriction to up gaze and in adduction (Figure 2). Orthoptic assessment revealed right eye hypotropia measuring 35 prism diopter, too high for surgical and prism correction.



Figure 1: 9 directions of gaze showing right hypertropia.



Figure 2: Case 2 : 9 direction of gaze photo showing right hypotropia in primary gaze, and restriction in up gaze and adduction.

Case 3

A 34-year-old lady, with underlying bronchial asthma and spina bifida, she has bilateral congenital glaucoma. The right trabeculectomy and left eye goniectomy were done when she was just 4 weeks. Subsequently, right repeat trabeculectomy was done to her right eye when she was 14 years old. Four years later when the trabeculectomy failed, Ahmad GDD was implanted at superior nasal area. The left

eye has good intraocular pressure however the cornea is opaque, the vision is hand movement. Hence, patient has no complaint of diplopia. However, 4 years later when she was studying for her degree she developed ocular motility problem. She had severe eye strain, headache and blurring of vision when doing near work. She was not able to converge. Ocular examination revealed that she had convergence insufficiency. Orthoptic exercise was prescribed.

DISCUSSION

Diplopia that develops postoperatively following GDD implantation is suggestive of restrictive mechanism that take place due to different GDD plate size, type of bleb formed and the scar tissue surrounding the plate [4]. In most cases it is combination of these factor [4]. Glaucoma drainage device with larger plate area (Baerveldt 350) result in higher frequency of diplopia as compared to GDD with smaller plate area (Ahmad valve) [4]. However, in The Ahmed Baerveldt Comparison (ABC) Study, similar presentation of diplopia is described for larger plate Baerveldt 350 (11%) and small plate Ahmad valve (12%) [5]. This similar occurrence between these 2 types of GDD could be the result of the non-standardized baseline as well as post operative motility assessment [4]. The GDD plate size is directly proportional to the surface area of encapsulation. Hence the rate of IOP

reduction is directly proportional to end plate size as well (6). The common factor seen in case 1, 2 and 3 regardless of the type of GDD is the scarring from multiple previous ocular surgery, either glaucoma or non-glaucoma surgery. The development of scarring post surgical intervention is compounded by their young age factor at the time of the surgery [4].

The location of the plate may suggest the direction of diplopia due to mass effect of fibrous tissue with the plate or bleb resulting in restrictive strabismus. Patient with superotemporal GDD increase the risk hypertropia, whereas GDD located on the superonasal quadrand prone to get hypotropia as observed in Case 2 and Case 3. However, true incidence of diplopia was probably underrated due to lack of complaint from monocular patients or patient with poor visual field defect and low vision [7].



Figure 3: Case 3: High filtering bleb over the reservoir in the superonasal quadrant affecting the medial rectus muscle contraction and thus limiting the convergence.

Table 1: Details of Case 1,2,3

Case	eye	VA	Glaucoma surgery	Non Glaucoma surgery	GDD type	GDD site	Type of bleb	IO P	No of Surgery/ eye	EOM restriction	Diplopia
1	R	6/ 24	trabec	cataract	BGI	ST	high	12	2	Up + abd	Vertical
	L	6/6	trabec	-			cystic	12	1		Vertical
2	R	6/9	-	cataract	AGV	SN	high	14	2	Up + add	Vertical
	L	6/12	trabec	cataract	AGV	ST	low	16	3	Nil	Vertical
3	R	2/60	trabec	Cataract TPPV	AGV	SN	high	14	6	Unable to converge	-
	L	HM	Goniotomy Trabeculectomy					18	2	-	-

BGI= Baerveldt Glaucoma Implant, AGV= Ahmad Glaucoma Valve, abd = abduction, add= adduction
ST= superotemporal, SN Superonasal

The Ahmed Glaucoma drainage device with a valve mechanism was first introduced in 1993. The initial result was first published by Coleman AL et al in 1995 [8]. In the early days of the implantation most surgeons implanted the device in the superonasal location straddling the superior and middle recti muscles as the space in this location effectively accommodate the large bleb that formed. However this location resulted in convergence insufficiency as seen in Case 2 and 3, as failure of convergence translate to poor accommodation, the patients' complaint was severe headache and blurring of vision.

Large bleb over the GDD plate as seen in Case 2 and 3 displaced the muscle away from the sclera causing muscle to stretch to a higher length of the curve tension thus affect the muscle motility. Furthermore large bleb surrounding the GDD leads to formation of a crowding effect with restricted extraocular movement which induces constant diplopia [6]. Treating diplopia is challenging because of formation of large and dense fibrous tissue capsule surrounding the implant which blended to the adjacent extraocular muscle, which treating the strabismus has high risk of damaging the functioning GDD [9].

CONCLUSION

Diplopia is an important complications of glaucoma drainage device, affecting patients with existing restricted visual function. It is important to counsel the patients prior the surgery as diplopia would significantly interferes with patient's daily activities hence their quality of life.

REFERENCES

1. L. Robbins *et al.*, Strabismus After Ahmed Glaucoma Valve Implantation, *Am J Ophthalmol*, vol. 222, pp. 1–5, Feb. 2021, doi: 10.1016/j.ajo.2020.08.019.

2. E. Islamaj, C. P. Jordaan-Kuip, K. A. Vermeer, H. G. Lemij, and P. W. T. de Waard, Motility changes and diplopia after baerveldt glaucoma drainage device implantation or after trabeculectomy, *Transl Vis Sci Technol*, vol. 7, no. 5, Sep. 2018, doi: 10.1167/tvst.7.5.7.
3. E. Scherrer, L. M. Bachmann, O. Job, L. Müller, M. A. Thiel, and F. Bochmann, Occurrence of motility disorders in patients undergoing tube surgery—consecutive, retrospective follow-up case series analysis, *Graefe's Archive for Clinical and Experimental Ophthalmology*, vol. 259, no. 8, pp. 2363–2371, Aug. 2021, doi: 10.1007/s00417-021-05202-3.
4. P. Y. Sun, D. A. Leske, J. M. Holmes, and C. L. Khanna, Diplopia in Medically and Surgically Treated Patients with Glaucoma, in *Ophthalmology*, Elsevier Inc., Feb. 2017, pp. 257–262. doi: 10.1016/j.ophtha.2016.10.006.
5. E. J. Rockwood, The Ahmed Baerveldt Comparison (ABC) Study: Long-Term Results, Successes, Failures, and Complications, *American Journal of Ophthalmology*, vol. 163. Elsevier Inc., pp. xii–xiv, Mar. 01, 2016. doi: 10.1016/j.ajo.2015.12.031.
6. H. Tanabe, S. Nakakura, A. Noguchi, H. Tabuchi, and Y. Kiuchi, Plate size reduction surgery for the Baerveldt 350-mm² glaucoma implant for postoperative motor disturbance: A case report, *Medicine (United States)*, vol. 98, no. 37, Sep. 2019, doi: 10.1097/MD.00000000000017163.
7. A. Abdelaziz *et al.*, "Diplopia after glaucoma drainage device implantation," *Journal of AAPOS*, vol. 17, no. 2, pp. 192–196, Apr. 2013, doi: 10.1016/j.jaapos.2012.11.017.
8. Coleman AL, Hill R, Wilson MR *et al.* Initial clinical experience with the Ahmed Glaucoma Valve implant, *Am J Ophthalmol* 1995 Nov;120(5):684
9. J. González-Martín-Moro *et al.*, Latrogenic diplopia, *International Ophthalmology*, vol. 34, no. 4. Kluwer Academic Publishers, pp. 1007–1024, 2014. doi: 10.1007/s10792-014-9927-7.