Original Article

Outcomes of rhegmatogenous retinal detachment surgery in eyes with pre-existing glaucoma drainage devices

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Purpose: To evaluate the outcome of rhegmatogenous retinal detachment (RRD) surgery in eyes with preplaced glaucoma drainage device (GDD) with respect to intraocular pressure (IOP) control as well as success of retinal detachment (RD) surgery. **Methods:** It is a retrospective case series. The case records of patients who underwent RD surgery after GDD implantation from 2000 to 2014 were screened. The demographic data, ocular examination findings at all visits, details pertaining to retinal detachment and its repair, and the postoperative course was documented. **Results:** Twelve patients were included in study. The mean age of patients was 24.3 years (median 11 years; range 3-72 years). Male: Female ratio was 3:1. Mean duration between GDD and RD was 24 months (4 days-91 months). Of the ten eyes that underwent surgery, nine eyes underwent pars plana vitrectomy, and in one eye scleral buckling was done. GDD was removed only in one eye. At final follow-up, retina was attached with controlled IOP in 6 (60%) eyes, of which 5 (50%) had improvement in best corrected visual acuity. **Conclusion:** Pars plana vitrectomy was required in almost all cases for the management of RD in eyes with preplaced GDD. Retinal reattachment with good IOP control could be achieved in 60% of eyes. Removal of the drainage device was not essential for the effective management of the RRD in most cases. With multidisciplinary approach, close follow-up and timely intervention, vision can be preserved along with glaucoma control and successful retinal reattachment.

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Glaucoma is a vision threatening condition, and glaucoma drainage devices (GDD) occupy an important place in the surgical management of glaucoma that is refractory to medications and trabeculectomy.[1] In tube versus trabeculectomy study, the cumulative probability of failure during 5 years of follow-up was 29.8% in the tube group and 46.9% in the trabeculectomy group.[2] The success rates of GDD in management of refractory glaucomas have been noted from 63% to 93% at first year and from 30% to 50% after 5 years.[3-13] Rhegmatogenous retinal detachment (RRD) after GDD implantation is a known complication[14] The incidences of RRD attributable to GDD at 1, 5, and 10-years are reported to be 1.25%, 2.02%, and 2.67%, respectively.[15] RRD following GDD may not be necessarily related to GDD surgery and its management is a challenge. RRD after GDD implantation may occur in isolation in eyes with predisposing factors such as lattices, vitreous prolapse, vitreous incarceration, retinal dialysis after pars plana tube placement, or in association with choroidal detachments and suprachoroidal hemorrhage, as a result of postoperative hypotony.[16] The challenges faced are decision of vitrectomy versus scleral buckling (SB), placement of the encircling band without disturbing the function of the GDD, and choice of tamponading agent. There are very few studies describing the outcome of RRD in eyes following GDD surgery.[17,18] Aim of this study is to evaluate the management of cases with GDD presenting with RRD and their surgical outcomes.

Methods

A retrospective review was undertaken to evaluate the surgical outcomes in eyes that underwent RRD surgery following GDD implantation. Case records of patients who underwent GDD from 2000 to 2014 were screened. The patients who developed RRD post implant were included in the study. The demographic data, best corrected visual acuity (BCVA), intraocular pressure (IOP), results of anterior segment and posterior segment examination at all visits using slit lamp, and indirect ophthalmoscopy were noted. Details pertaining to RRD and the surgical procedure carried out to repair it were noted. The details of the surgical method for the insertion of the GDD as well as retinal detachment repair is explained below.

Surgical method of glaucoma drainage device insertion

A corneal traction suture was placed (at 12 o' clock position for GDD planned superiorly and 6 o' clock for GDD planned inferiorly) to improve exposure in the working quadrant. A limbus-based conjunctival opening was made 5–6 mm behind

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the limbus to allow adequate exposure for insertion of the plate. The drainage device was anchored between 2 recti muscles with the anterior edge approximately 8–10 mm posterior to the limbus. Once the implant was appropriately positioned, the plate was secured to the globe with 2 non-absorbable sutures (9–0 nylon sutures). After the plate was anchored to the globe, tube was secured to the sclera a few millimeters anterior to the plate with a 9–0 monofilament nylon suture. The tube was inserted into the anterior chamber (AC) just anterior and parallel to the iris or behind it in pars plana. The tube was covered with partial thickness corneal or scleral patch graft to prevent its erosion through the conjunctiva. The patch graft was secured to the globe with interrupted sutures at the four corners by using 9–0 monofilament suture (Ethilon, Ethicon US). After the patch graft placement, the conjunctiva and tenon layers were pulled over the plate, tube, and patch graft and secured into place with 8–0 polygalactin suture (Vicryl, Ethicon US).

Surgical technique of retinal detachment surgery

Out of the 12 patients with RRD, ten underwent surgery. The other 2 patients were not willing for surgery and were lost to follow-up. These 2 patients were excluded from the final analysis. Decision regarding SB versus pars plana vitrectomy (PPV) was made depending upon the number, location, and extent of retinal break and the presence and severity of proliferative vitreoretinopathy (PVR). PPV was performed in nine eyes, while one eye was treated with SB. For PPV, complete vitrectomy with posterior vitreous detachment was done. Membrane peeling and sub retinal gliotic band removal followed by endolaser and intraocular tamponade was done. Precautions while sclerotomy placement and closure were taken so as not to disturb the GDD implant site. Encircling band (240) was used along with PPV in one case only. In this eye, GDD removal was done to make place for the encirclage.

SB was done in one case using 279 explant in the area of the retinal breaks inferiorly with trans-scleral cryotherapy to the retinal breaks. Encirclage was not placed so as to avoid disturbing the GDD implant site. Careful conjunctival closure was done at the end of surgery.

Successful outcome was defined by 3 criteria:

1. Anatomical success –Attached retina at final follow-up
2. Functional success –Attached retina with either improvement or maintenance of BCVA at the time of final follow-up
3. Successful IOP control – The cases having anatomical attached retina with IOP less than 21 mm Hg with or without antiglaucoma medications (AGMs).

Data regarding BCVA, IOP, number of IOP lowering medications used, and postoperative complications were retrieved from the records of all patients at each visit following RD surgery.

Results

Out of 656 patients who underwent GDD surgery from 2000 to 2014, 12 patients developed RRD post implant. Ahmed Glaucoma valve (New World Medical, Rancho Cucamonga, CA, USA) was used in 11 eyes and Aravind Aqueous Drainage Device (Aurolab, Madurai, India) in one eye.

The mean age of patients was 24.3 years (median 11 years; range 3–72 years). Male: Female ratio was 3:1. Table 1 depicts the preoperative characteristics of patients with RRD at presentation. Five eyes had congenital glaucoma, and four eyes were diagnosed with secondary glaucoma. The causes of secondary glaucoma included trauma in three eyes and uveitis in one eye. Mean duration between insertion of GDD and presentation of RRD was 24 months (median 7.5 months; range 4 days-91 months). Varying degree of severity of PVR was found in three eyes. One eye presented with superior dialysis, one eye presented with superior breaks, one eye had break in inferotemporal quadrant, and one eye presented with multiple breaks in temporal quadrant. In eight eyes, break could not be localized.

Two patients did not undergo surgical intervention and were lost to follow-up. These were excluded from the final analysis. Table 2 summarizes the details of RRD surgery, postoperative events, and the anatomical and visual outcome after surgery. Of nine eyes undergoing vitrectomy, silicone oil was used as endotamponading agent in eight eyes; while octa-fluoro cyclo propane (C_3F_8) was used in one eye. The GDD was retained in nine eyes. In one case undergoing vitrectomy, where encircling band was placed, the GDD was removed during RD surgery.

Postoperatively, 6 patients had attached retina. One patient who underwent SB, presented with recurrence of retinal detachment and subretinal fluid and gliosis. Out of 9 patients who underwent PPV, 6 patients had successfully reattached retina. One patient in whom C_3F_8 was used, presented with recurrent retinal detachment at 28 months.

Average BCVA after RD surgery (+1.8 Log Mar, SD +0.95 Log Mar) was better than the average BCVA on presentation with RD (+2.2 Log Mar, SD +1.0 Log Mar). Out of 6 patients with successful anatomical outcome, BCVA was improved in three eyes, while it was stable in three eyes.

In postoperative period, out of 6 patients who had achieved successful anatomical outcome, raised IOP was found in 5 patients, of which 2 cases were managed conservatively with AGMs. One patient had shallow AC with hypotony at first postoperative week and was managed with anterior chamber reformation in the immediate postoperative period. Further, in this case, increase in IOP was seen that was managed by silicone oil removal along with endocyclophotocoagulation. Endocyclophotocoagulation was done through parsplana route along with vitreoretinal procedure under local anesthesia with a diode laser probe. Silicone oil migration in AC causing tube blockade and raised IOP was found in three eyes. It was managed conservatively in 2 cases with IOP under control with AGMs. In one case, oil tap and endocyclophotocoagulation 1 month after RRD surgery was done as IOP could not be controlled with AGMs. GDD replacement was done in 2 patients. In one eye, tube blockage was seen owing to the presence of silicone oil in the AC resulting in elevated IOP refractory to AGM; oil tap was attempted along with tube re-positioning, diode cyclophotocoagulation, and YAG membranectomy; however, finally an additional GDD was required 19 months following RD surgery in the same eye. One eye that underwent GDD removal, a reimplantation was done 46 months later for elevated IOP.

The mean duration of follow-up was 24 months (median 24 months; range 8–42 months). At the final follow-up, 60% eyes achieved anatomical success, 50% achieved functional success, and 60% had successful IOP control.

Table 1: Preoperative findings (*n*=12)

Patient number	Age/sex (year)	Duration between GDD and RD	Lens status	Type of glaucoma	GDD type	Comorbid conditions	Placement of tube	Extent of RD	Location of rhegma
1	3/female	20 months	Pseudophakic	Congenital	AGV	History of LA, PPC, IOL implantation, and AV	AC	12 clock hours	Not localized
2	62/male	4 days	Pseudophakic	POAG	AGV	ECCE and IOL implantation	AC	5 clock hours	Not localized
3	3/male	14 months	Aphakic	Secondary	AGV	Lens extraction	AC	12 clock hours	Not localised
4	8/male	1 month	Aphakic	Secondary	AGV	History of penetrating injury and corneal tear repair	Pars plana	12 clock hours	Not loacalized
5	13/female	1 month	Aphakic	Congenital	AGV	Coloboma	AC	5 clock hours	Superonasal dialysis
6	5/male	22 months	Aphakia	Congenital	AGV	Nil	AC	12 clock hours	Not localized
7	12/male	91 months	Aphakia	Congenital	AGV	Microphthalmos	AC	9 clock hours	Temporal breaks
8	40/male	2 months	Phakic	Secondary	AGV	History of PK	AC	12 clock hours	GRT in sup quadrant
9	6/male	81 months	Aphakic	Congenital	AGV	Nil	AC	12 clock hours	ITQ break
10	10/male	6 months	Aphakic	Secondary	AADI	History of trauma and PK	AC	4 clock hours	Not localized
11	58/female	15 days	Pseudophakic	PACG	AGV	Nil	AC	5 clock hours	Not localized
12	72/male	9 months	Pseudophakic	PACG	AGV	Nil	AC	3 clock hours	Not localized

AGV: Ahmed glaucoma valve, POAG: Primary open angle glaucoma, LA: Lens aspiration, PPC: Primary posterior capsulorrhexis, IOL: Intraocular lens, AV: Anterior vitrectomy, ECCE: Extracapsular cataract extraction, PK-Penetrating keratoplasty, GDD: Glaucoma drainage device, RD: Retinal detachment, PACG: Primary angle closure glaucoma, AC: Anterior chamber, GRT: Giant retinal tear, ITQ: Infero temporal quadrant

Discussion

This study evaluates the management of RRD in eyes with pre-existing GDD in terms of IOP control and anatomical success. In contrast to other studies done on eyes with non-valved implants, in majority of eyes in our study valved glaucoma implant was used.

RRD following GDD may not be necessarily related to GDD surgery. Majority of patients in our study had history of trauma, and other intraocular procedures prior to surgery which in itself are a risk factor for RRD.

In our study, the interval of RRD from GDD surgery ranged from 4 days to 91 months with 50% of the patients presenting within 6 months of GDD implant surgery. In the study by Waterhouse *et al*.,[17] 70% patients presented within 4 months. Benz *et al*.[18] reported the interval between glaucoma surgery and RRD to range from 1–74 months.

The goals of the treatment strategies for the management of RRD following GDD implantation are to achieve retinal reattachment without disturbing the drainage of aqueous through the tube and maintaining IOP control. In our series, 60% achieved anatomical attachment of retina which is comparable to 56% success rate reported by Waterhouse *et al*.[17]

In our series, all cases except one (90% of eyes) were treated with PPV. One case which had break in inferior quadrant was treated with SB though the surgery was not successful. Waterhouse *et al*.[17] noted increased risk of recurrence of RD in the eyes that had undergone SB. Most of the cases in our study had complicated RD that are more likely to need PPV with silicone oil than SB. In addition, PPV reduces the necessity of disturbing the GDD. However, 8/9 cases needed silicone oil as tamponade. In the series by Waterhouse *et al*.,[17] the primary RD repair was done with PPV in 16/17 patients, and the rate of redetachment was similar (3/10) to our series. Moreover, the use of silicone oil as endotamponade had better outcome as compared to the gas. Higher rate of recurrent RD in cases with gas tamponade was because of PVR.

In 8 out of 9 cases undergoing PPV, repair of RD could be done without encirclage. One patient underwent placement of an encircling buckle requiring removal of the GDD. Need to remove encirclage have been noted by Benz *et al*.[18] as well in eyes needing encirclage. Decision to place encirclage was taken in our case because of very young age of the patient (3 years). Complete removal of vitreous specially at the base would be difficult in such young eyes, so encirclage was considered necessary to support the vitreous base.

Although the mean BCVA after RD surgery (+1.8 Log Mar) was better than the BCVA on presentation of RD (+2.2 Log Mar), the visual acuity gain was limited by other pre-existing comorbidities and glaucomatous damage. Majority of patients in our study had history of other intraocular procedures including penetrating keratoplasty in 2 eyes and comorbidities that itself is a risk factor for RRD and poor visual outcome.

Table 2: The surgical details of retina detachment repair and postoperative outcome (*n*=10)

Serial No.	Surgical procedure done	Gauge/ buckle	GDD management	BCVA at the time of RD	IOP at the time of RD	BCVA at final follow-up	IOP at final follow-up	Anatomical success	Postoperative events
1	IOL removal+ V+BB+EL+ SOI+AGV removal	20	Removed	Fixation	10	Cfcf	8	Yes	AGV reimplantation, 46 months post RD surgery
2	V+EL+SOI	25	Undisturbed	Cfcf	10	20/100	19	Yes	1 week later had hypotony and shallow AC-AC reformation done with healon; 10 months later, SOR with endocyclophotocoagulation done
3	V+EL+SRG removal+SOI	23	Undisturbed	Fixation	0	20/100	17	Yes	After 6 months, SOR done
4	V+EL+SOI	23	Undisturbed	HM	1	PL and PR inaccurate	2	No	At 1 year, recurrence of RD with PVR
5	V+MP+EL+SOI	20	Undisturbed	HM	6	Cf at 1 m	3	Yes	Raised IOP managed with AGM
6	V+EL+SOI	23	Undisturbed	HM	7	NPL	26	No	At 3 months, recurrence of RD with PVR
7	V+EL+LPFC+ SOI	23	Undistrubed	20/100	10	20/400	38	Yes	At 6 weeks, tube blockade-oil tap + membranectomy done; At 3 months, SOR + endocyclophotocoagulation At 15 months, tube repositioning At 19 months, second AGV implantation done
8	V+EL+C3F8	23	Undisturbed	HM	7	NPL	Soft	No	At 28 months, recurrent retinal detachment
9	SB	279, INQ	Undisturbed	HM	14	20/100	12	No	At 31 months, recurrent retinal detachment with PVR
10	PK+V+EL+ SOI+SRG removal	20	Undisturbed	HM	7	Cfcf	13	Yes	Late rise in IOP managed with AGM

BCVA: Best corrected visual acuity, V: Vitrectomy, BB: Beltbuckle, EL: Endolaser, SOI: Silicone oil, SRG: Subretinal gliotic bands, MP: Membrane peeling, LPFC: Liquid perfluoro carbon, SB: Scleral buckle, PK: Penetrating keratoplasty, Cfcf: Counting finger close to face, IOL: Intraocular lens, AGV: Ahmed glaucoma valve, RD: Retinal detachment, AC: Anterior chamber, SOR: Silicone oil removal, PVR: Proliferative vitreoretinopathy, AGM: Antiglaucoma medication, IOP: Intraocular pressure, GDD: Glaucoma drainage device, HM: Hand movement, PL: Perception of light, PR: Projection of rays, NPL: Nil perception of Light, INQ: Inferonasal quadrant

Poor visual outcome in our case series could be attributed to pthisis (n = 2), inoperable retinal detachment (n = 2), glaucomatous optic atrophy (n = 1), epiretinal membrane formation (n = 1), and corneal opacity (n = 1). Of six eyes that had successful anatomical outcome, one eye had deterioration of vision due to advanced glaucoma. Waterhouse *et al.*[17] also described post RD surgery complications such as intractable glaucoma (1/16), pthisis bulbi (6/16), and recurrent RD (7/16).

In the current series, out of 6 patients who had attached retina, IOP was raised in 5 patients and needed additional anti-glaucoma medications or procedures such as cyclophotocoagulation, GDD replacement at some point of time during follow-up. In early postoperative period, oil blocking the tube was cause of raised IOP in 2 patients and was treated with oil tap, whereas in late postoperative period, 2 patients needed GDD replacement. In series by Benz *et al.*,[18] for 2 patients, valves were removed in postoperative period due to hypotony, whereas in current series only one patient had early postoperative hypotony and could be managed by AC reformation. None of our patients needed valve removal due to hypotony. This may be because of the fact that Ahmed drainage device which is a valved one was used in the current series in 90% patients, whereas in other studies Molteno or Baerveldt implants were used which are non-valved implants.[17,18] These may have higher chances of postoperative hypotony.

Although our study is limited by its retrospective nature and small sample size, it does provide some useful insights into this "niche" group of patients. PPV gives better results as compared to SB; encircling band is avoided and in cases where it is necessary, it is prudent to remove the pre-existing device and reimplant it postoperatively as per the postoperative IOP, silicone oil is the preferred tamponade agent in these eyes.

Conclusion

Managing a case of RRD in glaucomatous eye with pre-existing GDD is very challenging. Most of these cases require PPV that can help to reattach the retina as seen in 60% of our cases. GDD removal is not necessary. Multidisciplinary approach and multiple surgical interventions are necessary to salvage these eyes. Need for meticulous and prolonged follow-up must be discussed with patients. With careful surgical maneuvers, close follow-up and timely intervention, vision can be preserved

along with glaucoma control and successful retinal attachment in eyes that develop RRD following GDD implantation.

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Conflicts of interest

There are no conflicts of interest.

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