Trabeculectomy with releasable sutures in primary glaucoma: A comparative study with the conventional technique

Parag Apte[1], Prachi Bakare[2,*], Minal Doulatramani[3], Divya Motwani[4]

[1,2]Assistant Professor, [3,4]Resident, Dept. of Ophthalmology, Dr. D.Y. Patil Medical College, Pimpri, Pune, Maharashtra, India

***Corresponding Author: Prachi Bakare**
Email: prachi.b7@gmail.com

Abstract

Aim: To compare the short term and long term efficacy of using releasable sutures versus the conventional permanent sutures for scleral flap suturing in trabeculectomy in terms of incidence of short term hypotony and its related complications, short term shallowing of anterior chamber, long term IOP control after operations by both techniques and post-operative bleb scores.

Materials and Methods: This is a prospective study carried out to compare the safety, efficacy and long term success rate of trabeculectomy with releasable suture verses trabeculectomy with permanent sutures. 60 eyes of primary uncontrolled glaucoma were subjected to trabeculectomy surgery, 30 using permanent sutures and 30 using releasable sutures. Patient were randomly assigned into 2 groups for conventional trabeculectomy with interrupted suture (group 1) and trabeculectomy with releasable suture (group 2). Patients were assessed postoperatively on visual acuity, intraocular pressure, anterior chamber depth, immediate complications, anterior chamber depth, post-operative lens changes.

Results: Majority patients were male. Age occurrence of open angle glaucoma was between 51-60 years while angle closure glaucoma was between 40 to 50 years. None of the eyes had severe hyotony (IOP less than 6 mmHg in trabeculectomy with releasable suture, while hypotony was a major complication in trabeculectomy with permanent sutures group. Post-operative mean IOP from the end of 3 months till 12 months was found to be equivalent in both groups. In group 1, 5 eyes (16.66%) anterior chamber was well formed compared to 21 eye in group 2. Bleb scores in both the groups suggested, none of the patients in Group 1 had high bleb score between 2-5 days while 13 patients (43.33%) in group 2 had high bleb score. Visual field loss progressed in 5 eyes, 16.66% in group 1. While none of patients had progressive field loss in group 2. Gross hypotony in immediate post-operative period was observed in group 1 while none pts in group 2 showed post-operative hypotony.

Conclusion: Suture release after trabeculectomy has been a useful adjunctive to conventional filtration surgery. It enables the filtration capacity to increase post operatively, decreasing the IOP without another invasive procedure or special instrumentation. It allows surgeon to achieve tighter closure of scleral flap with the assurance that filtration capacity can be increased as needed during post-operative period.

Keywords: Glaucoma, Releasable sutures, Trabeculectomy.

Introduction

Trabeculectomy remains the gold standard surgery till date for management of uncontrolled glaucoma. Trabeculectomy techniques have evolved from full thickness sclerectomy forms of filtration surgery to minimize post-operative complications while achieving the goal of successful lowering of intraocular pressure. Newer modality of treatment, nonpenetrating glaucoma surgery have been practiced over past few years but the main disadvantage of non-penetrating and non-bleb forming procedures is less dramatic IOP lowering to a level that may not be low enough for some patients and still allow glaucoma progression in patients.[1,2]

Several refinements to surgical technique and post-operative care such as use of antimetabolites, argon laser suture lysis and releasable sutures have improved the success rates of trabeculectomy but complications continue to occur at significant rate.

Trabeculectomy is considered effective, relatively low risk, and technically within the skills of well-trained ophthalmic surgeon. Several refinements to surgical technique and postoperative care such as the use of antimetabolites and releasable sutures have improved the outcome. Trabeculectomy with releasable sutures can be done without any extra instrumentation or any advanced skills as well as a technique to minimize postoperative complication like hypotony.

This study was carried out to compare the results of trabeculectomy with permanent sutures with trabeculectomy with releasable sutures.

Materials and Methods

This is a prospective study carried out in department of Ophthalmology at a charity based hospital in Pune. This study was carried for a period of 2 years from June 2014 to June 2016. Institutional ethical clearance was obtained. Written and informed consent was taken. Patients included in the study were explained about the procedure and expected results and risks were informed. Patients included in the study were of age more than 40 years, patients with primary open angle glaucoma, patients with primary angle closure glaucoma, intraocular pressure uncontrolled on anti-glaucoma medication with progressive visual field loss. Patients requiring combined surgery for cataract and primary open angle glaucoma were excluded. Patients with secondary glaucoma, juvenile glaucoma, congenital glaucoma, patients with previous ocular surgery, patients with conjunctival scarring, patients with previously failed filtering surgery were also excluded. Demographic data of each patient was recorded. Vision unaided and aided was recorded on Snellen's chart. Patients underwent detailed ocular

examination. Grading for anterior chamber depth was done on the basis of Van Herrick's protocol. IOP was recorded on goldmann applanation tonometry. Gonioscopy was performed using Volk 4 mirror. Perimetry of each patient was performed on Humphrey field analyzer. Eyes with glaucoma progression was described with a mean deviation loss of 3dB or more from 'baseline' VFs to the most recent test.

Open angle was diagnosed on gonioscopy with angles open, POAG was defined in the presence of an IOP > 21 mmHg, open anterior chamber angle on gonioscopy, glaucomatous optic disc damage on clinical examination, and corresponding glaucomatous visual field defects.[5] PACG was defined in the presence of an occludable angle on gonioscopy (posterior trabecular meshwork not seen in at least 180° of the total circumference of the angle in primary position), glaucomatous optic disc damage, and corresponding glaucomatous visual field defects.[5]

Patients with uncontrolled IOP with maximum medical therapy, non-compliant to medical therapy, patient showing progression on visual field in spite on maximum medical therapy were posted for trabeculectomy with mitomycin.

Patient were randomly assigned into 2 groups for conventional trabeculectomy with interrupted suture and trabeculectomy with releasable suture.

Surgical Technique

Conventional trabeculectomy, limbal based conjunctival incision was taken. A limbus based rectangular graft was created, an inner rectangular scleral flap was excised with help of 11 no blade and vannas scissors so as to make an opening in the anterior chamber. A peripheral button hole iridectomy was done. The superficial flap was then closed with interrupted 10-0 nylon suture. 2 sutures were used at the edges of rectangular flap. The conjunctiva was then sutured with 8-0 polyglactin absorbable suture.

Releasable Suture Technique

The technique of releasable suture of placing the releasable suture was similar to that used by Cohen and Osher with an additional modification done by Koller and Kass in order to keep free end of slip knot buried.[6] The needle of 10-0 nylon suture was first passed into the sclera and then through scleral flap. The needle was then passed through the base of scleral flap beneath the conjunctival and was brought out finally through peripheral cornea. A similar suture was then taken at second edge of scleral flap. The releasable sutures were tied with a quadruple throw slip knot tightened enough till only minimal aqueous humor could flow at the edges of scleral flap. The needle which was brought out from the peripheral cornea was then passed for second pass through peripheral cornea, the suture was the cut flush to the corneal surface leaving exposed loop but no free end to abrade the corneal epithelium.

Post-Operative Management

All patients were started on topical prednisolone eye drops 6 to 8 times a day, moxifloxacin eye drops 4 times a day, homatopine eye drops, 2 times a day. Antiglaucoma medications were continued in the other eye. All patients were examined in outpatient department on, 1st day, 5th day, weekly for 1 month, then each patient was followed every month for 3 months and then every 3 monthly up to 1 year.

In group 2, suture release was done on slit lamp with help of MacPherson's forceps (usually within 1 to 14 days) to lower the intraocular pressure to target level based on the preoperative history of progression and severity of glaucomatous damage.

Patients were assessed on visual acuity, intraocular pressure, anterior chamber depth, immediate complications, anterior chamber depth, post-operative lens changes.

Anterior chamber depth was assessed on slit lamp, central distance between anterior surface of lens and cornea. Shallow anterior chamber depth < 1mm. Flat anterior chamber was complete apposition of iris to cornea, Deep anterior chamber was anterior chamber depth more than 1mm.[7]

Cataract grading was done according to Lens opacity classification.[8]

Bleb type and score was classified according to Midgal and Hitchings classification.[9]

Score 1 was an absent Bleb. Score 2 was an elevated engorged conjunctiva. Score 3 was a pale elevated area with engorged conjunctiva. Score 4 was a residual conjunctival vessel engorgement around suture line. Score 5 was a pale and diffusely elevated conjunctiva. Score 6 was a cystic conjunctival elevation.

Filtration surgery was considered as an early failure if the postoperative IOP was higher than the upper limit of target IOP range.[7,9]

Statistical Analysis

Data will be entered in Microsoft Excel and statistical analysis will be done using software Epilnfo or SPSS. Statistical analyses will be performed using the statistical software.

The variables of each group trabeculectomy with permanent suture (group 1) were compared with trabeculectomy with releasable suture (group 2). The significance of was studied on the basis pf probability, which was calculated by aired't' test and Fisher Exact test.

Results

Among 40 male patients trabeculectomy with permanent sutures done in 20 patients and trabeculectomy with releasable sutures in 20 patients. Among 20 females, 10 had trabeculectomy with permanent sutures and 10 had trabeculectomy with releasable sutures. Out of 30 trabeculectomy with permanent sutures operations performed, 23 operations were performed on open angle glaucoma and 7 on angle closure glaucoma. Out of 30 trabeculectomy with releasable sutures performed, 20 had open angle glaucoma and 10 had angle closure glaucoma.

Table 1: Intraocular pressure (IOP) after trabeculectomy

	Trabeculectomy with permanent sutures		Trabeculectomy with Releasable sutures		
	No of eyes	**Mean IOP mm hg**	**No of Eyes**	**Mean IOP mm hg**	**P value**
Day 1	30	5.48(+/-1.19)	30	10.91(+/-2.91)	<0.0001
2-5 days	30	6.48(+/-1.53	30	11.91(+/-2.69	<0.0001
6-10 days	30	7.84(+/-1.44	30	12.34(+/-2.46	<0.0001
14-21 days	30	9.28(+/-1.30	30	12.38(+/-2.08	<0.0001
1 month	30	12.81(+/-2.25	30	12.46(+/-2.11	N.S
3 month	30	12.81+/-2.25	30	12.46(+/-2.11	N.S
6 month	30	12.81+/-2.25	30	12.46(+/-2.11	N.S
12 month	29	12.81+/-2.25	30	12.46(+/-2.11	N.S

Table 2: Mean preoperative and postoperative IOP in patients of trabeculectomy with permanent sutures and trabeculectomy with releasable suture

S. No.	description	Range of IOP in mmHg	Trabeculectomy with permanent sutures		Trabeculectomy with releasable sutures	
1	IOP on admission		No.	%	No	%
		25 to 35	13	43.33	11	36.66
		35 and above	17	56.66	19	63.33
2	IOP between 2-5 days	Above21	5	16.66	0	0
		10-21	0	0	22	73.33
		Less than10	25	22	8	26.66
3	IOP at end of 3 months	Above 21	5	16.66	0	0
		10-21	9	30	26	86.66
		Above21	16	53.33	4	13.33
4	Average IOP at end of 1 year		11.9 mm hg		12.4 mm hg	

The above table shows the mean post-operative intraocular pressure in both the groups up to a period of 1 year. The table shows that the mean intraocular pressure in mmHg on day 1 was 5.48 with standard deviation of 5.48 +/- 1.19 in trabeculectomy with permanent suture group and 10.91 with standard deviation of +-2.91 in trabeculectomy and releasable suture group P value (<0.0001). This was found to be statistically higher significant. From day 2 to day 5 the mean IOP was 6.48 with SD of +/- 1.53 in trabeculectomy with permanent suture group while it was 11.91 with SD +/- 2.69 in trabeculectomy and releasable suture group. This was found statistically highly significant.

From day 6 Today 10 the mean IOP in in trabeculectomy with permanent suture group was 7.84 with SD of 1.44 and in trabeculectomy and releasable suture group it was 12.34 with SD of 2.46 (P value <0.0001). This was statistically significant. From day 14 to day 21 it was observed that mean IOP was 9.28 mm hg with SD of +/- 1.30 in trabeculectomy with permanent suture group and 12.38 mm hg with SD +/- 2.08 in trabeculectomy and releasable suture group.

At the time of admission 17 eyes (56.66%) selected for trabeculectomy with permanent sutures, out of IOP higher than 35 mm hg, and 13 eyes had IOP between 25 to 35 mm hg.

19 eyes were operated for trabeculectomy with releasable sutures with IOP more than 35 mm hg, and IOP between 25 to 35 mm hg in 11 eyes.

Day 2-5 - In Group 1, 5 (16.66%) patients had IOP more than 21 mm Hg, 25 (83.33%) patients had IOP less than 10 mm hg. Similarly, in group 2, 22 (73.33%) patients had IOP between 10 to 21 mm hg, while 8 Patients had (26.66%) had IOP less than 10 mm Hg.

At end of 3 months, In Group 1, 5(16.66%) patients had IOP more than 21 mm Hg, 9 patients had IOP between 10 - 21 mm hg, while remaining 16(53.33%) patients had IOP less than 10mm hg.

In Group 2, 26 (86.66%) had IOP between 10 to 21mm hg, 4 (13.33%) patients had IOP less than 10 mm hg. None of the patients in this group required anti glaucoma drops or repeat surgery.

Table 3: Post-operative anterior chamber depth

S. No	Condition of A.C	Trabeculectomy with Permanent sutures		Trabeculectomy with releasable sutures		Total
		No.	%	No	%	
1	A.C formed (Grade 3)	5	16.66	21	70	26
2	A.C shallow (Grade 2)	12	40	5	16.66	17
3	A.C collapsed (grade 1)	13	43.33	4	13.33	17
4	Cases requiring more than 5 days to form A.C	6	20	0	0	6

In group 1, 5 eyes (16.66%) anterior chamber was well formed, while 13 (43.33%) eyes anterior chamber was collapsed. While in group 2, 21 eyes (70%) had well-formed anterior chamber, 4 eyes (13.33%) had collapsed anterior chamber.

The above table shows the formation and type of bleb in both the groups. None of the patients in Group 1 had high bleb score between 2-5 days while 13 patients (43.33%) in group 2 had high bleb score.

25 eyes (83.33%) had low bleb score in group 1.

The bleb score at end of 1 months shows high bleb score in 30 patients. While 5 patients had flat bleb in group 1.

In group 1 visual field loss was arrested in 14 (46.66%) eyes. In group 2 visual field loss was arrested in 19 eyes (63.33). Visual field loss progressed in 5 eyes i.e. 16.66% in group 1. While none of patients had progressive field loss in Group 2.

In group 1, 18 eyes (60%) showed slow progression of cataract, 14 eyes (46.66%) in group 2 showed slow cataract progression.

No rapid progression was seen in any of cases in group 2, while 2 eye (6.66%) showed rapid cataract progression in group 1.

The density of cataract remains unchanged in 10 eyes (33.33%) in group1, n 16 eyes 53.33% in group 2. None of the patients were operated for cataract surgery in any of the group.

The table clearly shows that 16 eyes (53.33%) showed gross hypotony in immediate post-operative period while none pts in group 2 showed post-operative hypotony.

5 eyes (16.66%) in Group 1 required repeat surgery for control of IOP. Since the IOP could not be brought under control with medical line of treatment. None of the patients in group 2 required any medical or surgical line of treatment. Final success rate in term of control of IOP in both the groups at the end of 12 months was 100%.

Table 4: Formation and type of bleb

S. No	Description of bleb		Trabeculectomy with permanent sutures		Trabeculectomy with releasable sutures		Total
			No	%	No	%	
1	High bleb score (score 3 and above)	2-5 days	0	0	13	43.33	13
		1 month	25	83.33	30	100	55
2.	Low bleb score (score 2)	2-5 days	25	83.33	17	56.66	42
		1 month	0	0	0	0	Nil
3.	Flat bleb (score 1)	2-5 days	5	16.66	0	0	5
		1 month	5	16.66	0	0	5

Table 5: Changes in visual field at the end of 3 months

S. No	Description	Trabeculectomy with permanent suture		Trabeculectomy with releasable suture		total
		No	%	No	%	
1.	Visual field changes arrested	14	46.66	19	63.33	33
2.	Visual field loss progression	5	16.66	0	0	5
3	Visual field not done due to visual acuity less than 1 meter	11	36.66	11	36.66	22
4	Total	30		30		60

Table 6: Immediate post-operative complications

S. No	Description	Trabeculectomy with permanent suture		Trabeculectomy with releasable sutures		Total
		No	%	No	%	
1	hypotony	16	53.33	0	0	16
2	hyphema	3	10	2	6.66	5
3	iritis	3	10	2	6.66	5
4	hypopyon	0	0	0	0	0
5	Failed trabeculectomy	5	16.66	0	0	5

Discussion

The aim of trabeculectomy is to lower intraocular pressure (IOP) in order to slow the progression of glaucomatous optic neuropathy and visual loss.[10,11]

In trabeculectomy, aqueous outflow is determined by the size, shape, and position of the scleral flap use of antimetabolites, suture position, tension, and application of laserable, adjustable, or releasable sutures.[12-15]

The releasable suture technique was shown to be an effective and safe method of providing sufficient aqueous humor outflow by easily removing the sutures with forceps.[16-18]

Trabeculectomy with Releasable sutures can be performed without any need of specific Instrumentation. The technique is easier to perform and post-operative care is a similar to trabeculectomy with permanent sutures

Releasable suture has been associated with foreign body sensation, irritation, keratopathy due to exposed sutures, conjunctival leakage after suture removal, or endophthalmitis caused by externalized sutures that are contaminated with bacteria.[19]

This study was conducted to compare the pros and cons of trabeculectomy with permanent suture and releasable suture. The measurement of IOP is the main indicator success of glaucoma surgery.

In our study, intraocular pressure post trabeculectomy (Table 1) observation clearly shows that mean IOP was relatively higher in group 2 from day 1 to day 21 as compared to group 1. The IOP on day 1 was 10.91 +/- 2,91 in group 2 as compared to 5.548 +/- 1.19 in group 1. None of the patients showed hypotony in group 2 compared to 16 patients i.e 53.33% in group 1. Suture release was done whenever the pressure was higher than target levels. Suture release was done usually in early postoperative period between 1 to 10 days. The findings were comparative with studies done by Kolker and Kass, Raina and Tuli.[16,17]

Mean preoperative and postoperative IOP in patients of Trabeculectomy with permanent sutures and trabeculectomy with releasable suture (Table 2) shows the IOP control in 2 groups. It is observed that none of eyes had IOP above 21 mm Hg in group as compared to 5 eyes i.e. 16.66% in group 1, Similarly only 8 eyes i.e. 26.66% in group 2 had IOP <10mm hg as compared to 25 eyes i.e. 83.33% in group 1 which indicates significant hypotony.

At end of 3 months, in group 1, 5(16.66%) patients had IOP more than 21 mm Hg, 9 patients had IOP between 10-21 mm hg, while remaining 16(53.33%) patients had IOP less than 10 mm hg. In group 2, 26 (86.66%) had IOP between 10 to 21 mm hg, 4 (13.33%) patients had IOP less than 10 mm hg. None of the patients in this group required anti glaucoma drops or re-surgery. In the early postoperative period IOP was controlled better in the releasable suture group.[20]

5 patients from group 1 required repeat surgery for pressure control, while in group 2 none of the patients required repeat surgery or anti glaucoma drops.

It was found that 70% of the eyes in group 2 had well-formed anterior chamber as compared to only 5 eyes (16,66%) in group 1. (Table 3) This was highly significant finding indicating good IOP control. The use of adjustable sutures may reduce the incidence of shallow anterior chamber and hypotony.[21]

Bleb morphology after trabeculectomy is an important clinical parameter; a careful evaluation of bleb morphology in the early postoperative period may reveal features that predict functional outcome, i.e. success or failure.[22]

Bleb scores suggested that at end 2-5 days none of the eyes in group 1 had a high bleb score, while 13 eyes 43.33% from group 2 had a high bleb score. At end of 1 month a high bleb score was found in all the 30 eyes in group 2 compared to 25 eyes in group 1. This indicates that in early post-operative period a better bleb score was observed in group 2 which indicative of good diffused filtration as compared to low bleb score in group 1. (Table 4). The results at end of 1 month were not found statistically significant indicating that the filtration rate is equivalent in both groups. These findings correlated with Midgall n Hitchings. Group 1 had low and localized bleb while group 2 had diffuse pale bleb indicating better filtration and good IOP control. The desired appearance of bleb is diffuse and elevated with relatively avascular but not an ischemic conjunctiva.[23]

It was seen that at end of 3 months none of the groups showed a rapid loss of visual acuity. Regarding postoperative lens changes in both the groups it was observed that slow progression of cataract was noticed in 14 eyes (46.66%) in group 2 as against 18 eyes (60%) in group 1, while no detectable changes was observed in 16 eyes (53.33%) in group 2 as compared to 10 eyes (33.33%) in group 1. A delay in progression of lens changes in group 2 may probably be due to a well formed anterior chamber as compared to group 1 where shallow anterior chamber was more common.

Visual field changes at the end of 3 months showed visual field progression was arrested in 19 eyes (63.33%) in group 2 as compared to 14 eyes (46.66%) in group 1 (Table 5). 5 eyes in group1 (16.66%) where trabeculectomy failed showed progressive visual field loss.

Observation of Immediate postoperative complications in both groups (Table 6) clearly indicated that none of the eyes in group 2 showed immediate postoperative hypotony as compared to 16 yes (53.33%) in group1 where hypotony was observed. This suggests that one of the major complications of trabeculectomy can be avoided by using trabeculectomy with releasable sutures. No corneal complications of any kind were observed with the use of releasable suture. Our study findings are comparable with studies done by de Barros DS. He stated that Releasable scleral flap sutures reduce the incidence of complications of early postoperative over filtration after trabeculectomy.[18] As a result, there are fewer cases that might require reformation of the anterior chamber and drainage of suprachoroidal fluid. Similar results were observed by Kolker and Kass.[17] Thomas and Jacob.[24]

None of the patients in group 2 required any medical or surgical line of treatment while 5 patients in group 1 required repeat trabeculectomy after 3 months.

Conclusion

Suture release after trabeculectomy has been a useful adjunctive to filtration surgery. It enables the filtration capacity to increase post-operatively thus decreasing IOP without another invasive procedure. It allows the surgeon to achieve a relatively tight closure of scleral flap intra-operatively with the assurance that filtration capacity can be increased as needed during the early postoperative period. Minor adjustment in the surgical technique at no extra cost or instrumentation resulted in significant reduction of complications subsequent to trabeculectomy. The study clearly brings out that the long term IOP reduction, anterior chamber depth and bleb scores were achieved better with releasable sutures than conventional trabeculectomy as well as ensuring better long term function of filter.

Conflict of Interest: None.

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