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Original Article

To Study the Incidence of Glaucoma and Clinical Outcomes in Patients Undergoing Penetrating Keratoplasty for Healed Microbial Corneal Lesions with Follow up of 6 Months

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ABSTRACT

Purpose: To evaluate the incidence of glaucoma and clinical outcomes in patients undergoing penetrating keratoplasty for healed microbial corneal lesions with follow up of 6 month.

Material and Methods: Penetrating keratoplasty alone or triple procedure was performed in 40 eyes of 40 patients with healed microbial corneal lesions and incidence of post PKP glaucoma and clinical outcome was evaluated in terms of graft survival and final best corrected visual acuity.

Results: 13 patients (32.50%) developed post-operative glaucoma. Out of these 4 cases (30.76%) had pre-operative raised tension, Vascularisation was present in 7 cases (53.84 %) and anterior synechiae was present in 7 cases (53.84%). Out of 13 cases that developed raised tension, 7 cases (53.84%) had glaucomatous changes, 6 cases (46.15%) were left aphakic, 3 patients was left pseudophakic and 4 cases were phakic. Final vision was improved in 6 (46.15%) cases.

Conclusion: Presence of pre-operative vascularised corneas was more prone to graft rejection. Glaucoma was common in graft rejection cases and larger size of graft. Patients with pre-operative high intraocular pressure, anterior synechiae, vascularisation had poor visual outcome and high incidence of glaucoma post-operatively. Post-penetrating keratoplasty glaucoma was higher in aphakes compared with phakic or pseudophakic eyes. Post-penetrating keratoplasty glaucoma patients had poor visual outcome.

KEYWORDS: Healed microbial corneal lesions, Penetrating keratoplasty, Triple procedure, Post PKP glaucoma, Visual outcome.

INTRODUCTION

Post-penetrating keratoplasty (post-PK) glaucoma is an important cause of irreversible visual loss and graft failure. Post-PK glaucoma is defined as an elevated IOP greater than 21 mmHg, with or without associated visual field loss or optic nerve head changes. The etiology for this disorder is multifactorial, and with the use of new diagnostic equipment, it is now possible to elucidate the exact pathophysiology of this condition. Diagnostic difficulty arises due to errors in tonometry recordings of a thick or astigmatic corneal graft. In addition, it is often not possible to assess adequately the optic nerve and visual field before surgery or in the immediate post-operative period because of pre-operative media opacification and post-operative corneal distortion with high astigmatism, respectively.[1,2]

Risk factors for glaucoma in patients undergoing PKP include[1-7] pre-existing glaucoma previous PKP, aphakic and pseudophakic bullous keratopathy, mesodermal dysgenesis, irido-corneal-endothelial syndrome, perforated corneal ulcer, adherent leucoma, post-traumatic cases, combined PKP and cataract extraction, performance of vitrectomy during PKP, anterior segment reconstruction.

The causes for elevated IOP in the early post-operative period are post-operative inflammation, retained viscoelastic substances, wound leak with angle closure, hyphaema, operative technique (Tight suturing and long bites with compression of the angle, larger recipient bed with same size donor button, increased peripheral corneal thickness), pupillary block glaucoma, malignant

glaucoma, pre-existing peripheral anterior synechiae, pre-existing glaucoma, PKP in aphakic eyes secondary to mechanical angle collapse.

The causes for elevated IOP in the late post-operative period are preexisting glaucoma, graft rejection with glaucoma, PKP in aphakic eyes, ghost cell glaucoma, PKP combined with cataract extraction, misdirected aqueous or ciliary block glaucoma, chronic angle closure glaucoma, epithelial down growth, steroid induced glaucoma, fibrous ingrowth.

MATERIALS &METHODS

This study presents the results of 40 eyes of 40 patients who received corneal grafts at GGS Medical College & Hospital, from June 2012 to June 2014.

Donor grafts were taken, which enucleated within six to eight hours of death and preserved by moist chamber method, transplanted within eight to ten hours of collection. Age, gender, indication of PKP, IOP and best corrected visual acuity constituting the preoperative data were recorded in a predesigned performa. The type of procedure defined as PKP alone and tripal procedure (PKP combined with an extracapsular cataract extraction and intraocular lens implantation).

Disc evaluation was performed in cases where media was clear and permitted a view of the disc. In some cases, fundus evaluation was not possible because of irregular astigmatism or hazy media. Visual field analysis could not be done in any patient as vision in all patients was not more than or equal to 6/18 and therefore, intraocular pressure was the only criterion for assessing the progress or control of glaucoma.

Table-1: Post-operative analysis of raised IOP in patients

S. No.	IOP				IOP	IOP	IOP	IOP
	Day 1	Day 3	Day 7	2nd wks	1st m	2nd m	3rd m	6th m
1.	22.3	24.7	22.3	18.5	18.7	16.0	20.2	19.4
2.	37.9	40.5	37.9	28.4	29.4	32.9	38.1	36.8
3.	35.7	32.9	36.2	34.7	28.3	30.5	24.4	27.2
4.	47.3	42.6	40.1	29.6	31.6	42.9	43.5	36.4
5.	27.8	24.7	16.7	17.5	20.4	17.9	19.4	16.7
6.	37.5	32.1	34.7	29.5	40.9	41.3	30.6	39.1
7.	44.6	38.6	36.2	44.4	32.4	35.4	44.4	37.7
8.	23.7	20.6	19.3	17.4	16.7	17.4	14.9	16.3
9.	37.9	32.4	24.6	19.7	20.3	18.5	19.4	28.4
10.	27.9	30.4	27.3	18.5	19.8	19.8	17.4	26.7
11.	39.5	44.7	32.6	34.3	35.4	32.9	25.9	29.3
12.	37.9	30.6	26.3	34.7	24.4	32.4	21.9	28.7
13.	34.9	28.5	30.4	24.7	32.7	34.6	38.8	26.3
14.	24.7	23.2	16.4	18.9	19.3	18.4	15.4	16.7

Table 2: Glaucoma in patients

	Cases	Average size of graft	Pre-operative				Post-operative			
			Raised tension	Normal tension	Anterior Synechiae	Vascularisation	Fundus (no. of cases of disc changes)	Lens status	Improved Visual outcome	Incidence
1st M	8	8.25 mm	3 37.5%	5 62.5%	4 50%	5 62.5%	G.C.-4 50%	A-6 IOL-1 Ph-1	5	26.6%
3rd M	8	8.25 mm	3 37.5%	5 62.5%	4 50%	5 62.5%	G.C.-4 50%	A-6 IOL-1 Ph-1	5	26.6%
6th M	13	8.20 mm	4 30%	9 70%	7 53.84%	7 53.84%	G.C.-7 53.84%	A-6 IOL-3 Ph-4	6	32.5%

Table 3: Showing the size of the graft of all patients and their risk for glaucoma at 6th month

Graft size in mm.	Total No. of cases	Glaucoma Present at 6 months	Glaucoma Absent at 6 months
7.5	5 (12.5%)	-	5 (100%)
8.0	26 (65%)	8 (30.76%)	18 (69.23%)
8.5	9 (22.5%)	5 (55.55%)	4 (44.44%)
Total	40 (100%)	13 (32.5%)	27 (67.5%)

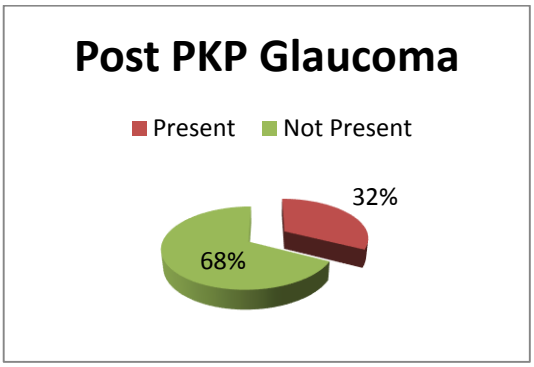

Table 4: Comparision with previous studies.

Sr.No.	Studies	Early glaucoma (<3 months) Incidence	Late Glaucoma (>3 months) Incidence
1.	**Our study**	12.50%	20%
2.	**Karesh JW et al**	31.25%	28.75%
3.	**Olson RF et al**	9-30%	18-29%
4.	**Folks GN et al**		
5.	**Ing JJ et al**		
6.	**Thompson et al**		
7.	**Karadag O et al**		
8.	**Fan JC et al**	53%	
9.	**Franca et al**	21.5%	
10.	**Allouch C et al**	42.2%	
11.	**Sihota R et al**	10.6%	
12.	**G Chandra Sekhar et al**	27.4%	

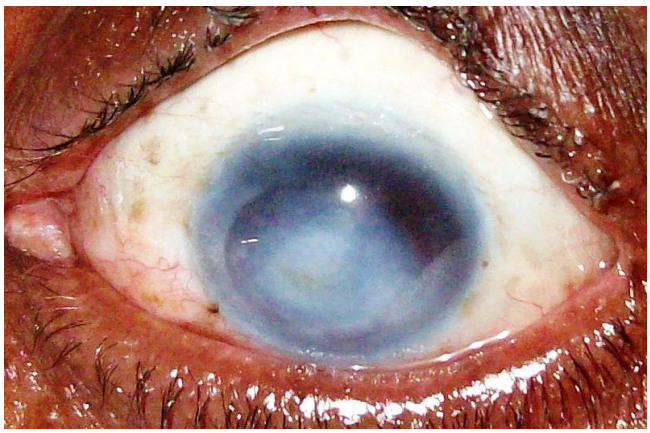

Fig 1: Healed viral keratitis

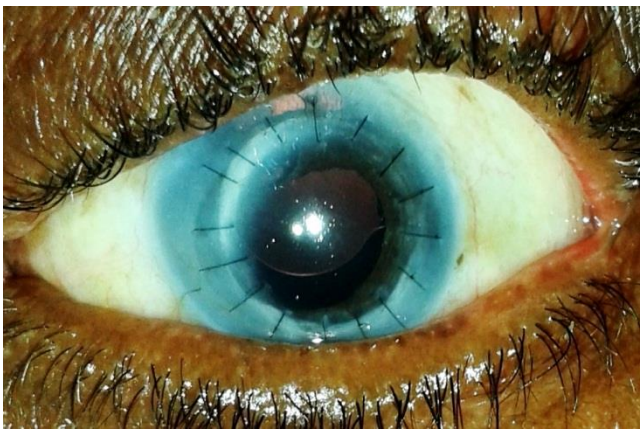

Fig 2: 6 months follow up after PKP. The graft survived successfully.

RESULTS

40 patients underwent PKP, 72.50% were male and 27.50% female .Mean recipient age was 54.02 years (range 11-80). Indication for PKP was healed microbial corneal lesions, 37.50% were healed bacterial, 32.50 % healed fungal and 30% healed viral keratitis.

At 6 months, 13 patients (32.50%) developed post-operative glaucoma. Out of these 4 cases (30.76%) had pre-operative raised tension, Vascularisation was present in 7 cases (53.84 %) and anterior synechiae was present in 7 cases (53.84%). Out of 13 cases that developed raised tension, 7 cases (53.84%) had glaucomatous changes, 6 cases (46.15%) were left aphakic, 3 patient was left pseudophakic and 4 cases were phakic. Final vision was improved in 6 (46.15%) cases.

DISCUSSION

Penetrating keratoplasty is an effective treatment for corneal diseases with poor vision. The out come of PKP depends upon indication, method of donor cornea preservation, operative techniques and postoperative care.

At 6 months, 13 patients (32.5%) developed post-operative glaucoma. Out of these 4 cases (30.76%) had pre-operative raised tension. Vascularisation was present

in 7 cases (53.84 %) and anterior synechiae was present in 7 cases (53.84%). Out of 13 cases that developed raised tension, 7 cases (53.84%) had glaucomatous changes, 6 cases (46.15%) were left aphakic, 3 patient was left pseudophakic and 4 cases were phakic. Final vision was improved in 6 (46.15%) cases.

In a study done in 1998, Sihota R et al found that pathophysiology of post-PKP glaucoma is multifactorial and may be related to distortion of the angle with collapse of the trabecular meshwork, suturing technique, post-operative inflammation, use of corticosteroids, peripheral anterior synechiae (PAS) formation, and preexisting glaucoma.[2]

In present study, anterior synechiae were present in 17 (42.5%) cases (out of which 41.17% had glaucoma at 6 months as compared to 26.08% cases where anterior synechiae was absent with p=0.314; not significant). PAS formation pre-operatively or as a consequence of a preceding intraocular surgery was significantly associated with the development of post-operative glaucoma. Vascularisation and inflammation were present in 19 (47.5%) cases (out of which 47.36% had glaucoma at 6 months as compared to 19.04% cases where vascularisation and inflammation was absent with p=0.054; not significant). França ET et al. (2002) found that the presence of ocular inflammation before in the pre- or post-operative period is an important risk factor for post-PKP glaucoma.**[3]** In eyes with vascularised corneal scar the incidence of post-penetrating keratoplasty glaucoma was considerably high (30.7%).**[3]**

20 cases were aphakic (out of which 40% had glaucoma at 6 months), while 8 (20%) patient (out of which 25% had glaucoma at 6 months) was pseudophakic and 12 (30%) cases had cataract (out of which 25% had glaucoma at 6 months**)** p=0.436; not significant**.** Sihota R et al in 1998 reported that post-penetrating keratoplasty glaucoma was significantly higher in aphakes compared with phakic or pseudophakic eyes.**[2]**

Intraocular pressure was found raised pre-operatively in 08 (20%) cases (out of which 62.5%cases had glaucoma at 6 months), low in none and normal in 32 (80%) cases (out of which 25% had glaucoma at 6 months) p=0.043; significant statistically. Karadag et al reported the incidence of post-PKP glaucoma to be 59.4% in eyes with pre-existing glaucoma in contrast to 14.6% in cases without such a history.[4] G Chandra Sekhar et al aphakia (37%), pseudophakia (24%), preexisting glaucoma (81.8%), and regrafting (43.18%) were found to be the significant risk factors in the development of glaucoma following penetrating keratoplasty.**[5]**

Grafts of 7.5mm size were used in 5 cases. Grafts of 8.0mm were applied in 26 cases (out of which 30.76% developed glaucoma) and grafts of 8.5mm were used in 9 cases (out of which 55.55% developed glaucoma). So, glaucoma was more in 8.5 graft size (p=0.559; not significant).

Post-operative status of keratoplasty patients and their risk for glaucoma at 6 months: 7 cases (17.5%) had allograft reaction. Out of these, 6 cases (85.71%) had pre-operative anterior synechiae and 6 cases (85.71%) pre-operative vascularisation. Out of these, 3 cases (42.85%) had pre-operative raised IOP. Post-operatively, 7 cases (100%) had vascularisation and 4 (57.140%) patients had raised IOP. Final improvement in vision was seen in 1 case (14.28%). Karadag O et al in 2010 found that inflammatory diseases such as graft thinning (relative risk [RR] = 4.96), traumatic scar formation (RR = 2.66), graft abscess (RR = 2.62), graft rejection (RR = 2.61), bullous keratopathy (RR = 2.59), and corneal abscess (RR = 1.52) were found to be risk factors for the development of glaucoma.[4] Bullous keratopathy, graft rejection, history of glaucoma, and trauma were reported to be high-risk factors for IOP elevation following PKP. 20 (50%) cases were aphakic (out of which 40% had glaucoma at 6 months), while 8 (20%) patient (out of which 25% had glaucoma at 6 months) was pseudophakic and 12 (30%) cases had phakic (out of which 25% had glaucoma at 6 months). Sihota R et al in 1998 reported that post-penetrating keratoplasty glaucoma was significantly higher in aphakes compared with phakic or pseudophakic eyes.**[2]** Zimmerman et al. proposed that the mechanical collapse of the trabecular meshwork in aphakic grafts was the main problem leading to glaucoma.**[6]** They postulated that the trabeculum needs posterior fixation offered by the ciliary body-lens support system and an anterior support offered by the descemet's membrane. In aphakia, the posterior support was relaxed with the removal of the lens. aphakic and pseudophakic eyes in the presence of PAS had a greater tendency to develop post PKP glaucoma when compared with phakic eyes. 8 cases were operated for cataract extraction & intraocular lens implantation along with penetrating keratoplasty. Out of these 7, 5 cases (62.50%) had final visual improvement. Out of these 8 cases, 2 patients (25%) developed raised IOP at 6 months. Seitz et al found that an IOP > 21 mm Hg and/or application of topical antiglaucoma medication was documented in 11% of PKP only versus 15% of triple-procedure cases.[7] Foulks GN et al (1987) had found that statistically significant risk factors for development of glaucoma were pre-existing glaucoma and aphakia.[8] Aphakia (37%), pseudophakia (24%), preexisting glaucoma (81.8%), and regrafting (43.18%) were found to be the significant risk factors in the development of glaucoma following penetrating keratoplasty.

Final best corrected visual acuity achieved was: >6/60 in 13 cases (32.50%). 9 cases (22.50%) had vision between 6/60-4/60. 16 cases (40.00%) had vision of 3/60 or less. While in 2 cases (5.00%) there was no vision at the end of follow up. Visual outcome in glaucoma patients were PL/PR in 3 cases (23.07%), HM in 2 cases(15.38%),

1/60 in 1 patient(7.69%), 2/60 in 1 patient (7.69%), 3/60 in 3 patient (23.07%), >3/60 in 3 patients(23.07%). So, vision less than 3/60 in 7 patients. Two things that are important in managing a case of post-PK glaucoma are the influence of glaucoma on graft survival and the effect of glaucoma in causing permanent irreversible visual loss. A study from center based on a retrospective review of 747 PKs reported only 50% graft clarity over the study period[2] and further worse only 19% of eyes could retain a visual acuity of 20/60 or better despite medical and surgical measures to control the glaucoma.

Patients studied prospectively developed post-operative glaucoma in (12.5%) patients at Early (1st, 3rd months) and 10 (20%) patients at Late (6th months) respectively which was supported by previous studies.

Karesh JW et al (1983) had found factors associated with early (less than three months) and late (more than three months) post-operative increases in intraocular pressure in a retrospective series of 80 eyes and conclude that of the 80 eyes, 25 (31.25%) had early increases in intraocular pressure and 23 (28.75%) had late increases.[9] Also incidence of present study at the end was 32.50%.

So in our study, allograft reaction (graft rejection) and aphakia,were important risk factor for post-PK glaucoma. Pre-operative 4 patients had glaucoma. But after penetrating keratoplasty, glaucoma developed in 13 patients.

CONCLUSION

Incidence of glaucoma after penetrating keratoplasty in patients with healed microbial lesions, were 32.50% at 6 month of follow up. Presence of pre-operative vascularised corneas was more prone to graft rejection. Glaucoma was common in graft rejection cases. Glaucoma patients were more in larger size of graft. Patients with pre-operative high intraocular pressure, anterior synechiae, vascularisation had poor visual outcome and high glaucoma cases post-operatively. Post-penetrating keratoplasty glaucoma was higher in aphakes compared with phakic or pseudophakic eyes. Post-penetrating keratoplasty glaucoma patients had poor visual outcome.

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