IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 17, Issue 6 Ver. 6 (June. 2018), PP 26-29
www.iosrjournals.org

Evaluation of corneal endothelial changes in Glaucomatous eyes undergoing trabeculectomy: a hospital based prospective study in north India

Lt Col (Dr) Ashok Kumar[1], Brig (Dr) Poninder Kumar[2],
Col (Dr) Vinod Kumar Baranwal[3]
[1,2,3] Army College of Medical Sciences & Base Hospital, Delhi Cantt, New Delhi, India-10010
Corresponding Author : Lt Col (Dr) Ashok Kumar

Introduction*: Glaucoma is a disease in which a progressive loss of retinal ganglion cells is characterized by a recognizable pattern of both visual function loss & optic nerve pallor and excavation. Medical management of glaucoma has many drawbacks like lack of compliance by the patients, high cost factor, toxicity of drugs, drug resistance, continued loss of visual acuity and field despite adequate control of IOP and failure of regular follow-up visits. Glaucoma patient have decreased mean endothelial cell density. Corneal endothelial cell count has been shown to be further reduced after glaucoma filtration surgery. Decrease in endothelial cell count depends on no of factors like type of Glaucoma, Intra-operative use of mitomycin-C, post-op shallowing of anterior chamber.* ***Objective****: To quantify changes in corneal endothelial cell count, central corneal thickness and structural changes like pleomorphism/polymegathism in patients undergoing trabeculectomy..* ***Material & Methods****: Trabeculectomy was carried in 30 patients of Primary Open/Closed angle Glaucoma using standard technique. Pre-operatively and post-operatively at 01 & 06 weeks patients were evaluated by Specular microscopy, Pachymetry, IOP and best corrected visual acuity. Intra-operative Mitomycin-C in standard concentration was used in 11 patients with standard post-operative treatment regimen followed .* ***Results:*** *There was no statistically significant difference in cell count or pachymetry value change at 1 or 6 week post-operatively with a P value of > 0.05. No significant change in cell size (Polymegathism) or shape (Pleomorphism) was noted post-operatively. The IOP was well controlled in all patients post-operatively. Shallowing of anterior chamber was noted on 1st post-operative day in 3 patients (27%) whom Mitomycin-C was used which improved over next 2-3 days with conservative management without significant endothelial cell loss.* ***Conclusion:*** *Corneal endothelial cell density do decreases after Trabeculectomy like other intra-ocular surgical procedures. But there is no significant decrease in endothelial cell count or significant change in corneal thickness following Trabeculectomy when there is no prolonged shallowing of anterior chamber.* ***Keywords :*** *Glaucoma, Trabeculectomy, endothelial cell density, Mitomycin-C*

Date of Submission: 28-05-2018 Date Of Acceptance: 11-06-2018

I. Introduction :

The glaucoma is a disease in which a progressive loss of retinal ganglion cells is characterized by a recognizable pattern of both visual function loss & optic nerve pallor and excavation. Untreated natural course is toward blindness or at least significant visual disability [1]. Attempts have been made to control the progressive visual loss from the disease by controlling IOP through medical, surgical and laser therapy. Medical management of glaucoma has many drawbacks like lack of compliance by the patients, high cost factor, toxicity of drugs, drug resistance, continued loss of visual acuity and field despite adequate control of IOP and failure of regular follow-up visits. These facts forced the clinician to take a recourse to surgical management more often than perusing the unsuccessful path of satisfactorily controlling IOP [2]. Trabeculectomy is a filtering surgery for eyes with glaucoma. Trabeculectomy involves creation of a lamellar scleral flap, excision of a short length of canal of schlemm and forming a filteration channel into subconjunctival space [3]. Essential function of corneal endothelial cells is to maintain corneal transparency. Endothelial cell density decreases as age progresses [4]. Certain ocular diseases and especially surgical trauma leads to reduction in endothelial cell count [5]. Glaucoma patient have decreased mean endothelial cell density [6]. Corneal endothelial cell count has been shown to be further reduced after glaucoma filtration surgery [7, 8]. There can be many causes for corneal endothelial cell damage during trabeculectomy. This damage can be compounded by the use of per-operative mitomycin-C in augmented trabeculectomy. An important factor leading to the damage of corneal endothelium is post-operative shallow anterior chamber and duration of same [9-12]. A study was therefore undertaken at a tertiary eye care centre in North India with the aim to study corneal endothelial changes in form of endothelial cell counts, central corneal thickness and structural changes like polymegathism or pleomorphism

II. Materials & Methods

A study to evaluate corneal endothelial changes was carried out among the patients undergoing Trabeculectomy at a tertiary eye care centre in north India. It was a prospective, interventional study with all patients of primary Glaucoma whether open angle or closed angle on gonioscopy fitting into criteria for filtration surgery (definitive progression of glaucoma despite being on maximal topical therapy) were included over a period of 01 year (01 Jan 2017 to 31 Dec 2017). We excluded all patients of secondary glaucoma, patients with advanced corneal diseases precluding specular microscopy,

patients who underwent Phaco-trabeculectomy, patients with pseudo-exfoliation syndrome or patients who were unable to complete follow-up.

All patients were evaluated with BCVA, IOP using Goldmann applanation Tonometer, Gonioscopy, detailed fundus examination including disc evaluation. These all patients were subjected to endothelial cell count using Topcon SP-2000P model and central corneal thickness measurement using Pachette 2 (Model DGH-550) pre-operatively and repeated at 01 week and 06 week postoperatively and compared using paired-T test for data analysis.

Surgical Procedure

All cases were operated under peri-bulbar anaesthesia by the same surgeon with good surgical experience. Irrigation of the ocular surface with 0.5% betadine solution followed by rinsing with Ringer lactate solution. Application of eye speculum & superior rectus suture done. Limbal based conjunctival flap, 8 mm post to upper limbus. Light thermal cauterization of prominent vessels on sclera. A 5 mm square partial thickness scleral flap dissected 1 mm into clear cornea. Completion of trabeculectomy by cutting 4x1 mm rectangular area of the deep sclero-trabecular lamella followed by peripheral button hole iridectomy. Repositioning of scleral flap and closure of scleral incision by 2-3 interrupted 8-0 silk sutures. Repositioning of conjunctiva-Tenon's flap and closure with 10-0 silk sutures. Sub-conjunctival injection of Dexamethasone + Amikacin given and eye patched for 24 hours. Post-operatively all the patients received oral antibiotics for 5 days, topical steroids, cycloplegics and NSAIDS.

Post-operative follow-up:- Pad and bandage were opened on 1st post-operative day. Antibiotic- steroid drops & cycloplegics instilled & eye observed for post-operatve inflammation or shallowing of anterior chamber. Schedule for post-operative follow-up was- Day 1, 2, 7, 14, 28 & 42. Specular Microscopy (Fig 1) & Pachymetry (Fig 2) were performed pre-operatively, at 1 week & 6 week post-operatively (Table 1).

Fig 1: Specular Microscope

Fig 2: Pachymetry

III. Results

Total 30 patients were recruited in this study and underwent trabeculectomy procedure with standard techniques by same ophthalmologist. Out of total 30 patients, 20 (66.6%) were cases of Primary open angle glaucoma (POAG) and 10 (33.3%) were cases of angle closure glaucoma (PACG). Of total 30 patients in this study 18(60%) were male & 12(40%) were female (Fig 3). The mean age of patients included was 57.9years (ranging from 32-74 years). Vision of patients undergoing trabeculectomy ranged between 20/200 to PL+ve and IOP ranged between 22-38 mm Hg on maximal topical medication (Table 1).

Average endothelial cell count pre-operatively was 2156 $\pm$ 223.34 cells per millimeter square with cell count decreased to 2104 $\pm$ 234.67 cells per millimeter square at 1 week post-operatively with 2.4% decrease in cell counts which was not significant ($p > 0.05$). Endothelial cell count at 06 week post-operative was 2056 $\pm$ 257.27 cells per millimeter square with 4.6% decrease from baseline which was also not significant ($p > 0.05$).

In PACG group, average endothelial cell count pre-operatively was 1711$\pm$ 232.67 cells per millimeter square, which was lower than the POAG group but no significant decrease($p>0.05$) was observed in endothelial cell count at 01 week and 06 week (3.2% decrease at 01 week and 6.2% at 06 weeks).

Mitomycin-C augmented trabeculectomy was done in 11(36.6%) patients. Average endothelial cell count pre-operatively in this group was 2065± 220.7 cells per millimeter square, which was lower than the POAG group but no significant decrease($p>0.05$) was observed in endothelial cell count at 01 week and 06 week (3.2% decrease at 01 week and 6.24% at 06 weeks) which was comparable to PACG group. Shallowing of anterior chamber was observed in 03(22.7%) patients in Mitomycin-C group, but they responded to conservative management in form of patching with well formed anterior chamber in 24-48 hours.

On evaluation of central corneal thickness(CCT), average CCT pre-operatively was 502 micron metre which increased to 526 micron metre at 1 week post-operatively(4.78% increase from baseline) and 533 micron metre at 6 weeks post trabeculectomy(6.17% increase) which were non significant with $p>0.05$. No statistically significant difference in central corneal thickness was observed in sub-groups of patients treated with mitomycin-C augmented trabeculectomty or PACG patients. No obvious change in cell size (Polymegathism) or shape (Pleomorphism) was noted post-operatively.

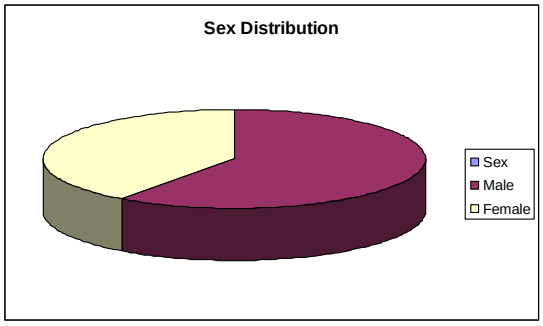

Fig 3: Sex Distribution of patients

S No	Age/Sex	Diag.	DVA	IOP	C:D ratio	Specular Count Pre 1st wk 6th wk	Pachymetry (um) Pre 1st wk 6th wk
S No	Age/Sex	Diag	DVA	IOP	C :D	Specular Count Pre 1 wk 6wk	Pre 1 wk 6wk
1	50/F	POAG (RE)	6/60	24	0.9	2504 2430 2426	523 528 536
2	55/ M	POAG (RE)	1/60	26	0.9	2418 2368 2357	514 519 521
3	68/M	POAG (RE)	PL	28	0.9	1924 1869 1854	498 501 506
4	68/M	PACG (LE)	PL	26	0.9	2140 2104 2087	507 518 524
5	54/M	POAG (RE)	6/60	24	0.8	2510 2478 2462	496 494 492
6	66/F	POAG (LE)	4/60	24	0.7	2550 2538 2506	506 503 502
7	70/M	PACG (LE)	PL	38	0.9	1836 1668 1484	528 547 556
8	32/F	PACG (LE)	PL	28	0.9	2386 2296 2284	504 511 518
9	61/ M	PACG (LE)	PL	30	0.9	1868 1848 1822	536 540 542
10.	74/M	POAG (RE)	6/60	22	0.9	2238 2198 2182	526 529 530
11.	60/M	PACG (LE)	HMCF	30	0.8	2016 1964 1896	490 499 502
12.	51/F	POAG (RE)	2/60	28	0.8	2239 2208 2190	526 533 538
13.	32/M	PACG (LE)	6/60	34	0.7	2458 2408 2346	516 524 528
14.	47/F	PACG	1/60	30	0.8	2218 2164 2136	528 534 540
15.	60/F	POAG	3/60	28	0.9	2068 1986 1926	498 502 512
16.	65/F	PACG	HMCF	32	0.9	1866 1824 1738	536 542 556
17.	55/F	POAG	1/60	26	0.8	2114 2068 2004	526 532 542
18.	58/M	POAG	2/60	30	0.9	1894 1826 1746	518 524 532
19.	52/F	POAG	1/60	28	0.8	2424 2386 2294	546 548 558
20.	60/M	POAG	1/60	32	0.9	2278 2246 2228	512 516 522
21.	54/M	POAG	HMCF	30	0.9	1968 1920 1868	528 536 542
22.	56/M	POAG	3/60	28	0.8	2346 2318 2288	504 516 518
23.	60/F	PACG	HMCF	32	0.9	1892 1836 1728	496 508 524
24.	52/M	POAG	1/60	28	0.9	2006 1966 1884	548 554 558
25.	66/M	POAG	2/60	32	0.8	2236 2204 2168	544 558 562
26	65/M	POAG	1/60	32	0.8	2108 2054 1986	486 496 506
27	58/F	POAG	3/60	28	0.9	1958 1926 1872	562 574 588
28	64/M	POAG	4/60	30	0.9	2108 2052 2040	528 534 542
29	70/F	PACG	1/60	28	0.9	1856 1768 1726	544 554 568
30	56/M	POAG	3/60	26	0.8	2262 2206 2176	518 532 538

Table 1: Proforma of patients with endothelial cell counts ,central corneal thickness & clinical details

IV. Discussion

In the surgical management of glaucoma, trabeculectomy is the procedure of choice since its introduction by Cairns in 1968. Glaucoma surgery is known to induce a damage to corneal endothelium, a decrease of corneal endothelial cell density by 0.2-14.9% was reported by several authors There can be many causes for corneal endothelial cell damage during trabeculectomy. This damage can be compounded by the use of per-operative mitomycin-C in augmented

trabeculectomy. An important factor leading to the damage of corneal endothelium is post-operative shallow anterior chamber and duration of same.

Fiore and associates, reported 12% corneal endothelial cell loss in 8 eyes with shallow anterior chamber after trabeculectomy, but on the other hand, no significant decrease in cell density in 10 eyes with well maintained anterior chamber [13-16] and same has also been corroborated by our study as average endothelial cell loss at 1 week post-operative day was 52 cells per square millimeter (2.4% cell loss) which was statistically not significant($p>0.05$) and also at 6 week post trabeculectomy when cell loss was 100 cells per square millimeter(4.6%).

Use of antimetabolites like Mitomycin-C & 5-FU decreases fibroblast proliferation and increases success rate of filtration surgery. Use of Mitomycin-C may have transient deleterious effect on corneal endothelium [17]. Sharma et al studied deleterious effects of MMC on the corneal endothelium 3 months post-operatively and average endothelial cell loss was 3.73% in standard trabeculectomy and 13.9% in trabeculectomy with MMC [18]. Our studied showed comparable results with endothelial loss 3.2% decrease at 01 week and 6.24% at 06 weeks with 03 patients showing shallowing of anterior chamber on 1st post-operative day which was managed conservatively. Dreyer et al also studied effect of MMC on anterior segment and found 7-8% corneal endothelial cell loss as compared to preoperative counts [19] which were more than this study.

In PACG group, average endothelial cell count pre-operatively was lower than the POAG group but no significant decrease($p>0.05$) was observed in endothelial cell count at 01 week and 06 week (3.2% decrease at 01 week and 6.2% at 06 weeks). So, this was first attempt to study endothelial cell changes in different sub-groups of primary glaucoma patients undergoing trabeculectomy.

Corneal thickness is related directly to the health of corneal endothelium. Its measurement after cataract surgery and glaucoma surgery is an excellent indication of the amount of endothelial trauma sustained during surgery [20]. In our study, no statistically significant difference in central corneal thickness was observed in sub-groups of patients treated with mitomycin-C augmented trabeculectomty or PACG patients. No significant change in cell size (Polymegathism) or shape (Pleomorphism) was noted post-operatively.

Our study had advantage of studying different variable of endothelial cell changes in form of endothelial cell count ,central corneal thickness and structural changes in different subgroups of patient like POAG, PACG, with use of mitomycin-C undergoing trabeculectomy. The essential disadvantage of this study is short follow-up period of 06 weeks post-operative but it helped in depicting immediate post-operative changes which will have bearing on long term effects. Patients are being followed up for evaluation of long term effects on endothelial changes.

V. Conclusion

Glaucoma patient have decreased mean endothelial cell density. Corneal endothelial cell count has been shown to be further reduced after glaucoma filtration surgery. There can be many causes for corneal endothelial cell damage during trabeculectomy. This damage can be compounded by the use of per-operative mitomycin-C in augmented trabeculectomy. An important factor leading to the damage of corneal endothelium is post-operative shallow anterior chamber and duration of same. Maintaining proper deep anterior chamber during and after surgery can reduce endothelial cell changes and subsequent complications in these patients especially when performing mitomycin-C augmented trabeculectomy.

Références :

[1]. Ivan Goldberg. Glaucoma in the 21st century (2000) . Edited by RN Weinreb,Y Kitazawa GK Krieglstein, Mosby International Ltd,
[2]. Duke Elder Vol. XI : System of Ophthalmology, Diseases of the Lens and Vitreous, Glaucoma and Hypotony. Henry Kimpton, London : pg 380-388
[3]. Sihota R & Tandon R. In Parson's Disease of Eye (2007). 20th Ed. Elsevier;287
[4]. Fernando Cesar Abib, Jackson Barretto (2001). Journal of Cataract & Refractive Surgery Oct ;Vol 27; Issue 10; 1574-1578
[5]. Behringe D, Reinhard T, Speilberg HCL (2002). Influencing factor on chronic endothelial cell loss charecterised in a homologus group of patients. Br. J Ophthalmol; 86; 35-38
[6]. Gagnon MM, Boisjoly HM, Brunette I (1997). Corneal endothelial cell density. Cornea; 16;314
[7]. Amavielle S, Lafantaine PO, Bidot S, Creuzot-Gacher C (2007). Corneal endothelial cell changes after trabeculectomy & deep sclerectomy. J. of Glaucoma. May; 16(3):324
[8]. Smith DL, Skuta GL, Lindenmuth KA (1991). The effect of glaucoma filtration surgery on corneal endothelial cell density. Ophthalmic Surg ;22: 251
[9]. S Arnnavielle, PO Lofantine, S Bidot, C Creuzot-Garcher,PD'this, A M Brown (2007) . Journal of Glaucoma; Vol 16; No3; May ; 324-328
[10]. Beckers HJ,Kinders KC,Webers CA (2003). Five-year results of trabeculectomy with mitomycin C. Graefes Arch Clin Exp Ophthalmol;241: 106
[11]. Derick RJ, Pasquale L, Quigley HA (1991). potential toxicity of mitomycin C.Arch Ophthalmol;109: 1635
[12]. Harish C Agarwal, V K Anuradha, J S Titiyal, Vinay Gupta (2005). Effect of intra- operative inatracameral 2% Hydroxypropyl methylcellulose viscoelastic during trabeculectomy. Ophthalmic Surgery, Lasers and Imaging; Vol 36; No 4; July/Aug
[13]. Fiore PM, Richter CU, Arzeno G, Arrigg CA, Shingleton BJ, Bellows AR, Hutchinson BT(1989). The effect of anterior chamber depth on endothelial cell count after filtration surgery. Arch Ophthalmology; 109: 1609-1611
[14]. Korey M, Gieser D, Kass MA, Waltman SR, Gordon M, Becker BL(1982). Central corneal endothelial cell density and central corneal thickness in ocular hypertension and primary open-angle glaucoma. Am J Opphthalmol; 94: 610-616
[15]. Smith DL, Skuta GL, Lindenmuth KA, Musch DC, Bergstrom TJ(1991). The effect of glaucoma filtering surgery on corneal endothelial cell density. Ophthalmic Surg; 22: 251-255
[16]. Barak A, Alhalel A, Kotas R, Melamed S (1992). The protective effect of early intra-operative injection of viscoelastic in trabeculectomy. Ophthalmic Surg; 23: 206-209
[17]. Rappaport, Liebmann, Ritch : Antimetabolites in glaucoma filtering Surgery, Advances in Clinical Ophthalmology Vol. 1, 1994, Mosby Year Book Inc.
[18]. Sharma T, Sihota R, Agarwal HC (1998): Intraoperative Mitomycin & the Corneal endothelium, Acta Ophthalmol Scand Feb; 76 (1):80-82
[19]. Dreyer EB, chaturvedi N, Zurakowski D (1995) : Effect of Mitomycin- C & Flurouracil supplemented trabeculectomies on the anterior segment, Arch Ophthalmol May; 113 (5): 578-80
[20]. Daniel M Albert, Frederick A Jakobiec: Principles and Practice of Ophthalmology. 2nd edition; Chapter-60: 664-665.