ORIGINAL RESEARCH PAPER

Ophthalmology

OUTCOME OF COMBINED CORNEAL TRANSPLANTATION AND CATARCT SURGERY IN TERMS OF ANATOMICAL AND FUNCTIONAL SUCCESS: A RETROSPECTIVE ANALYSIS

KEY WORDS: penetrating keratoplasty, cataract surgery, combined surgery,regrafts

Bharti Ahuja* Senior resident ,Department of Ophthalmology Govt .Medical College Chhindwara (M.P)* Corresponding Author

Radhika Natarajan Senior consultant Department of cornea Sankara nethralaya ,Chennai

ABSTRACT

The purpose of this paper is to study the outcome of corneal triple procedure with respect to anatomical, visual and refractive success in a tertiary eye care centre . One hundred and twenty eyes who underwent this procedure between January 2012 to December2016 were reviewed retrospectively and analysed **.** Mean age of these patients was 42.45 years (SD+/-15.85) .Failed therapeutic grafts(Regrafts)-42.5% was the main indication for performing triple procedure in this study .At the last follow up, graft clarity was seen in 63.33 % eyes. 65 % eyes had improvement in terms of visual acuity. Visual acuity improved by 5 snellen lines or more in 55.83% eyes.38.33% eyes achieved an improvement of 2 to 3 snellen lines. Mean spherical equivalent and mean refractive cylinder at 1 year after the procedure was found to be -0.229D (SD+/-2.48)and -4.21D(SD +/-2.39). respectively. Combined approach seems to be an effective surgical procedure with reasonable outcome in form of visual rehabilitation and graft survival even in regrafts situation.

INTRODUCTION :

Combined penetrating keratoplasty, cataract extraction and intraocular lens implantation(Corneal triple procedure) is a surgical technique for visually disabling corneal conditions with associated cataract .First described by Katzin and Meltzer in1966.It offers immediate postoperative visual improvement and precludes the need of another major intraocular surgery for cataract in future that may jeopardize the corneal graft .With the advent of new component corneal surgeries as lamellar keratoplasty, endothelial keratoplasty ; penetrating keratoplasty still seems to be a management option in patients with significant corneal scarring . We present the clinical profile ,visual outcomes, refractive results and success rates in eyes which underwent combined surgery at our tertiary eye care centre.

METHODS:

Approval of the institutional review board was obtained for this study which adhered to the tenets of the Declaration of Helsinki .The medical records of one hundred and twenty(120) patients who underwent combined corneal transplantation and cataract surgery (corneal triple procedure) between January 2012 to December 2016 in a tertiary eye care centre were retrospectively reviewed.

Demographic data,past ophthalmic history and indications for surgery were documented. Salient preoperative data included the initial visual acuity at the time of presentation, slit lamp findings of cornea(scar, haze, vascularisation, decompensation), anterior chamber and lens details , intraocular pressure status, posterior segment examination with the help of indirect ophthalmoscope or Bscan ultrasongraphy.Peribulbar block (2%xylocaine, 0.5% bupivacaine) was the most common technique of anaesthesia. Pupil was dilated preoperatively with 0.5% -1% tropicamide and 5% phenylephrine .Super pinkie was applied for a period of 5-10 minutes to have a soft eye prior to surgery after anaesthesia.

Donor corneal rims preserved in MC Carey –Kaufman medium were used .Size of Donor corneal button oversized the host corneal button by 0.5mm in all eyes. Size of donor corneal buttons ranged between 6-9.5 mm. Most common trephine size was 8.0 mm (45.13%) followed by 7.5 mm(33.63%). After the excision of host corneal button, anterior capsulotomy was done.The nucleus was delivered by bimanual technique.The rest of the procedure was same as cataract extraction by extracapsular technique.For intraocular lens power calculation, preoperative standard keratometry readings were used as K1= 44.00D @180 and K2=44.00D@ 90 respectively.The axial length for each eye was determined preoperatively and Intraocular lens power calculation was done using Sanders- Retzlaff-Kraaff II formula , SRK-T formula in cases of high axial lengths(>24mm). as the intraocular lens was placed in the posterior chamber or in the sulcus , Suturing of donor cornea was done with 16 interrupted sutures of 10 -0 nylon monofilament or with a combined 8 interrupted and single continuous 10-0 monofilament nylon suture in some cases. Postoperative medication regime included as topical steroids, topical antibiotics, lubricants, systemic steroids and anti glaucoma medications to all patients as applicable.Any additional procedure done during surgery,intraoperative, early and late postoperative complications were noted. Patients have been followed up in initial 2-3 weeks, 6 weeks (glass appointment), 3-6 months and then at 1 year. Suture removal depended upon the loosening of sutures and the amount of astigmatism. The final outcome was assessed in terms of graft clarity, final visual acuity, refraction at the last available visit. Graft clarity was taken as clear grafts with compact stroma and sharpely visible anterior segment details.

STATISTICAL ANALYSIS :

Data were presented as percentage (%) for qualitative variables, mean and standard deviation for continuous variables. Independent Student's test was done for comparison of continuous variables and Chi-square test for frequencies.p value <0.05 was considered statistically significant.

RESULTS:

One hundred and twenty (120) corneal triple procedures performed were included in this study. Of 120 patients, 25 (20.83%)were male and 95 (79.17%) were female.Mean age of these patients was 42.45 +/-15.85 years(range 9 to 75 years).The mean postoperative follow up was 15.08+/-12.8 months(range 1.5 to 49 months).Failed therapeutic grafts(42.5%)-was the common indication found for surgery.Preoperatively, intraocular pressure was increased in 11(9.16%) patients , out of which 04(36.36%) were managed surgically and rest 07(63.63%)with antiglaucoma medications . Conventional corneal triple procedure in terms of combined penetrating keratoplasty with extracapsular cataract extraction with intraocular lens implantation (PK+ECCE+IOL) was performed in 114 (95%) eyes , 01(0.83%) eye underwent keratoplasty with phacoemulsification with intraocular lens implantation(PK+PE+IOL), and secondary intraocular lens implantation (PK+IOL) in 05 (4.17%)eyes (Table-2).Various indications for procedure were listed as follows(Table - 1)

TABLE NO.1:INDICATIONS FOR TRIPLE PROCEDURE :-

S.no.	Indications	Frequency(n=120)
1	Regrafts	51 (42.5%)
2	Corneal scars	34 (28.33%)
3	Adherent leukomas	26 (21.67%)
4	Others*	09 (7.5%)

***Others include :**

S.no.		(n=9)
1	Fuchs dystrophy	05(55.5%)
2	Keratoconus	01(11.11%)
3	Chemical injury	02(22.22%)
4	Buphthalmos	01(11.11%)

TABLE NO.2:TYPE OF TRIPLE PROCEDURE:-

S.no.	Type of surgery	Frequency(n=120)
1	PK +ECCE +IOL	114(95%)
2	PK+PE+IOL	01(0.83%)
3	PK+ IOL	05(4.17%)

Seventy six (76) out of 120 (63.33 %)grafts were clear and 44 out of 120 (36.67%) grafts had failed .Out of which 12 (27.27%)eyes developed graft infection,10 (22.73%)eyes had uncontrolled rise in intraocular pressure, 21(47.73%) eyes had immunological rejection , 01(2.27%) was primary graft failure(Table-3&4)

TABLE NO.3:Causes of graft failure :-

S.no.	Causes	Frequency (n=44)
1	Graft infection	12(27.27%)
2	Rise in intraocular pressure	10(22.73%)
3	Immunological graft rejection	21(47.72%)
4	Primary graft failure	01(2.27%)

TABLE NO.4:Profile of failed grafts at last followup :-

S.no.	Primary indication for failed grafts	Frequency(n=44)
1	Regrafts	26(59%)
2	Adherent leucoma	06(13.6%)
3	Corneal scars	07(15.9%)
4	Others	05(11.36%)

Others include:
buphthalmos=01,trauma=01,trachoma=01,fuchs dystrophy=01, chemical injury=01

Corneal scars=07(viral=04)

The initial (preoperative) visual acuity was perception of light /upto counting fingers(CF) 1 meter in maximum cases(99.16%), in 01 eye(indication –keratoconus) only preoperative visual acuity was 20/120 (logmar-0.778).Postoperative Snellens' visual acuity noted as below (Table-5) .

TABLE NO.5:Best Corrected Visual acuity at last follow up :-

S. no.	Visual acuity	No.of eyes/patients
1	<1/60	42(34.2%)
2	1/60 to 5/60 (logmar=1.778to1.07)	11(9.2%)
3	20/200to 20/60 (logmar =1 to 0.477)	46(38.33%)
4	20/40 to 20/20 (logmar=0.30to 0)	21(18.33%)

Definite non corneal causes of decreased vision was noted in 10 patients ,all these were clear grafts . 06 eyes were damaged due to glaucomatous optic atrophy, 02 eyes were amblyopic,01 clear graft with scarred Choroidal neovascular membrane and 01 was a primary graft failure. Combined penetrating keratoplasty and cataract extraction was performed in 07(5.833%) eyes of monocular patients with a potential for visual recovery.The BCVA in these cases at presentation was CF 1 meter. Postoperatively , 06 patients had clear grafts with improvement in vision , 01 graft failed due to glaucomatous damage.

Refractive details(in form of manifest refraction) were available in 73 patients.

All post-operative refractions were transposed to negative cylinders for analysis.

Mean spherical equivalent at available followup was 0.229+/-2.48D. 41% of all eyes had postoperative refractive errors (spherical equivalents)within +/-2.0D of emmetropia. Postoperative refraction was targeted towards emmetropia in 61.12 % and towards -1.0 D myopia in 38.94% cases.Mean keratometric cylinder was available for only 30 patients so extrapolation of data was not possible(Table-6).

TABLE NO:6 Refractive details :-

S. no.	Parameters	
1	Mean axial length	23.64+/-1.85mm
2	Mean intraocular lens power implanted	19.95 +/-4.71D
3	Mean spherical equivalent	0.229+/-2.48D
4	Mean refractive cylinder	-4.21+/-2.39D
5	Range of spherical equivalent	-6.50 to +6.0D
6	Range of refractive cylinder	-1.0D to -16.00D

Vitreous upthrust was seen in 05(4.16%)eyes during surgery for which anterior vitrectomy was done .The common early postoperative complications included increased intraocular pressure in 22(18.33%)eyes ,increased Anterior Chamber reaction in 63(52.5%) and wound leak in 03 eyes(2.5%),managed with appropriate measures.Other complications noted as posterior capsular opacification in 18(15%)eyes,managed well with Nd :YAG capsulotomy and persistent epithelial defect in 05(4.16%) eyes, out of which 04 (80%)grafts failed due to secondary infection, 01 (20%)survived after appropriate treatment regimen.

DISCUSSION:

Fuchs dystrophy was the most common indication for triple procedure in 31.3-77%[2] of patients as reported in literature. Corneal scarring (including adherent leukoma)-66.4%with associated cataract was the most common indication found by Sridhar etal [1] .In our study therapeutic failed grafts (42.5%), followed by corneal scarring associated with cataract was found to be the most common indication(28.33%) . The proportion of corneal scars is very less in our study and found to be statistically significant (Z test for proportion, p value < 0.001)

Taylor [11]etal reported 77%clear grafts and 57%with visual acuity 20/40 or better;Lee [12] and Dohlman reported 73%clear grafts and visual acuity 20/50 or better in 47%of their patients .Various other series have reported a graft clarity of 90-100% [4-6].Sridhar [1]etal found 72%grafts clear after a mean follow up of 23.7+/- 17.6 months [1].As compared to other reports, graft clarity rate was found to be 63.33% with a visual acuity of 20/40 or better in 18.33% eyes in this study at a mean follow of 15.08+/-12.8 months (range=1.5 to 49 months), because failed therapeutic grafts(after infectious keratitis) was a major indication(42.5%) for corneal triple procedure, which are in themselves high risk grafts and with limited surgical success.

In this series of one hundred and twenty eyes , graft rejection has been found as a major cause for secondary graft failure(47.72%), secondary glaucoma in 22.73%, graft infection in27.27% which is in contradiction to other reported series mentioned earlier as postoperative glaucoma was seen as a major complication in 24% eyes in a series of 104 eyes, endothelial rejection in 16.2% by Meyer [14] etal; Sridhar [1]etal also reported secondary glaucoma in 13.5%, graft infiltrate in 5.8% and 18.3% secondary graft failures .Various Studies have shown that Intra ocular Lens power calculation with regression formulae in cataract surgery results in postoperative refractive errors within 2 diopters (D) of emmetropia in more than 90% of cases [8,9].In contrast, when a cataract and corneal opacity coexist, regression formulas are not as accurate because the ultimate corneal curvature is less predictable [10].Binder[6] etal analysed in a study of 43 consecutive triple procedures , a mean refractive error of 1.79Dand 70% of eyes achieved 20/40 or better corrected visual acuity , 48.8% achieved refractive errors within 2 diopters of emmetropia. Forty one (41%) of our patients had refractive errors within +/-2.0 diopters of emmetropia ,with 18.33% eyes achieved visual acuity of 20/40 or better with a mean spherical equivalent of 0.229+/-2.48D with a range of refractive error between -6.50 to 6.0D.Obvious explanation for decreased visual acuity at final follow up being the high risk grafts with expected less success rate and to achieve

precise refraction is out of question although optimum percentage of patients are within targeted refraction. Sridhar[1] etal studied 58.8%eyes within +/-2D of predicted refraction in 104 patients. Shimmura[15] etal studied 26-68% final refraction within +/-2.0D of target , with the range of refractive error between -14.7 to +8.0D.

Previous studies related to triple procedure for comparison [7]:

S. no	Study	Design	Num ber of eyes	Mean Follow up (months)	MSE (D)	Mean cylind-er	Eyes +/-2.0Dof target/emmetropia(%)	BCVA>/=6/12 (%)	Graft survival (%)
1	Nguyen [7]	retrosp	499	12	1.20	4.16	47	61	97
2	Gruenauer[17]	retrosp	53	20.5	-2.06	-4.00	47		100
3	Pinneros[18]	retrosp	93			3.90	42	65	
4	Present study	retrosp	120	15.08	0.229	-4.212	41	18.33	63.33

MSE-Mean spherical equivalent, BCVA-Best corrected visual acuity, retrosp=retrospective

CONCLUSION:-

Failed therapeutic grafts was found to be the most common indication for combined full thickness corneal transplantation and cataract surgery in our reported case series. This surgical procedure still seems to yield acceptable results for reducing visual disabilities particularly in high risk, failed grafts.

REFERENCES:

1. M.S Sridhar etal.Corneal Triple Procedure: Indications, Complications and Outcomes .A Developing country scenario. Cornea 2000;19(3);333-5
2. Pamel GJ,Taylor Dm.Combined procedures.In: BrightbillFS, ed.Corneal surgery.Theory,technique and tissue,2ndedition.St Louis: Mosby,1993:177-83
3. Hunkeler JD,Hyde LL.The triple procedure.Combined penetrating keratoplasty,extracapsular cataract extractionand lens implantation. An expanded experience. Am Intraocular Implant Soc J1983;9:20-4.
4. CrawfordGJ,Stulting RD,Waring GO 3d,Van Meter WS,Wilson LA. The triple procedure analysis of outcome,refraction,and intraocular lens power calculation.Ophthalmology 1986;93:817-24
5. Katz HR,Forster RK.Intraocular lens calculation in combined penetrating keratoplasty, cataract extraction and intraocular lens implantation.Ophthalmology 1985;92:1203-7
6. Perry S.Binder.Intarocular lens powers used in the triple procedure.Effect on visual acuity and refractive error. Ophthalmology 1985;92(11):1561-1566
7. DQ Nguyen,LL Mumford,MNA Jones.The visual and regractive outcomes of combined and sequential penetrating keratoplasty , cataract extraction and intraocular lens insertion .Eye (2009)23, 1295-1301
8. Hoffer KJ. Accuracy of ultrasound in intraocular lens calculation.Arch Ophthalmol 1981;99:1819-23.
9. SandersD R, Retzlaff J, Kraff MC. Comparison of empirically derived and theoretical aphakic refraction formulas. Arch Ophthalmol 1983; 101:965-7.
10. Perl T, Charlton KH, Binder PS. Disparate diameter grafting. Astigmatism, intraocular pressure, and visual acuity. Ophthalmology 1981; 88:774-80.
11. TaylorDm, Khaliq A, Maxwell R.Keratoplasty and intraocular lenses:current status.Ophthalmology 1979;86:242-54
12. Lee JR,Dohlman CH.Intraocular lens implantation in combination with keratoplasty.Ann Ophthalmol 1977;9:513-813
13. Buxton JN,Jaffe MS.Combined keratoplasty, cataract extraction and intraocular lens implantation . Am intraocul Implant Soc J1978;4:11
14. RogerFM,David CM.Assessment of success and complications of triple procedure surgery.Trans. Am. Ophth. Soc.vol. LXXXV, 1987
15. Shigeto S,Yoshie O, Hiroki S,jun S, Kazuo T.Corneal opacity and cataract .Triple procedure versus secondary approach .Cornea , Vol.22,No.3,2003
16. Das S, Langenbucher A, Jacobi C, Nguyen NX , Kruse FE, Naumann GO etal .Long term refractive and visual outcome after penetrating keratoplasty only vs the triple procedure in Fuch's dystrophy. Graefe's Arch Clin Exp Ophthalmol 2006; 244:1089-1095.
17. Gruenauer-Kloevekorn C,Kloevekorn-Norgall K , Duncker GIW, Habermann A.Refractive error after triple and non simultaneous procedures :is the application of a standard constant keratometry value in IOL power calculation advisable ?Acta ophthalmol Scan 2006;84:679-683.
18. Pineros OE, Cohen EJ, Rapuano CJ, Laibson PR. Triple vs non simultaneous procedures in fuch's dystrophy and cataract. Arch Ophthalmol1996;114:525-528.