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*RESEARCH ARTICLE*

# PENETRATING KERATOPLASTY: INDICATION, OUTCOMES, AND COMPLICATION.

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## *Abstract*

**Purpose:** This study is a modest and a humble attempt done with purpose of: analyzing the overall survival rate of corneal transplants, studying the various factors influencing the survival of the graft and studying the post-operative complications and correlating it with the several pre-operative, intra-operative and post-operative factors.

**Methods:** This prospective case note review identified 50 penetrating keratoplasties [25: Optical & 25: Therapeutic] performed during a period from Sept.2015 to Aug.2016 at S. S. G. Hospital, Vadodara (India). All the patients were followed for a minimum period of 3 months. Throughout the statistical analysis, the patients were divided into two major groups: Optical and Therapeutic. Preoperative risk factor, surgical technique, postoperative complications were analyzed.

**Results:** Maximum incidence of KP [52%] was seen in the age group >60 years [males and females inclusive]. Most frequent indication for OKP in the study cases was corneal leucomatous opacities [44%], followed by Pseudophakic Bullous Keratopathy [32%]. The age of majority of donor eyeballs was more than 60 years [68%] or between 41-60 years [26%] {Total: 94%}. The most common post-operative complications noticed were Vascularization [44%] Immune rejection [34%] glaucoma [26% ]Uveitis [14%] and infection [20%]. The most probable causes of failure in Optical and Therapeutic cases were: Complications after surgery, Immune rejection reaction and Primary Endothelial failure.



## Introduction:-

There are around 12 million blind persons in the country. Out of these 10% is due to corneal blindness including 2, 70,000 childhood blindness cases[1]. Visual rehabilitation with corneal transplantation may be a possibility in many of these corneal blindness cases. So, also at times when severe corneal infection due to any reason jeopardize the structural integrity of eye ball and all other conservative measures fail, its penetrating keratoplasty, once again that comes to rescue[4].

Outcomes, including failure and complication of procedure, are well known and appear dependent on several factors i.e. recipient etiology, preoperative comorbidity and health of donor tissue. Modern day success in

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transplantation is attributed to eye bank storage technique, ocular pharmacology, equipment and modern surgical technique[2].

This fact has inspired this modest attempt to study the factors responsible for the failure of this sight restoring and integrity preserving surgery in our impoverished conditions.

## Materiales and Methods:-

This prospective study will include 50 penetrating keratoplasties performed during a period from Sept.2015 to Aug.2016 at S. S. G. Hospital, Vadodara after taking all inclusion and exclusion criteria's in consideration .

**Inclusion criteria:-**

1)All the patients with visual acuity of minimum, light perception and projection of light rays in all quadrants.2) All cases with non healing corneal ulcers, recurrent corneal ulceration, perforated corneal ulcer and corneal ulcers not responding to any medical line of treatment were taken for therapeutic penetrating keratoplasty.3)All cases of leucomatous corneal opacities following any reason like trauma, ulcer, and chemical burns etc. but having at least good perception and projection of light and posterior segment anomaly ruled out on USG B-Scan.4)All case of corneal dystrophies and degeneration.5)All cases of keratoconus and ectasias.

**Exclusion criteria:-**

1) Patients not having light perception and projection of light rays.2) Patients with multiple graft failure.3) Patients with known case of glaucoma.4) Patients with uncontrolled D.M. & H.T.5) Patients age less than 12 year.6) Pregnant females.

After taking written and informed consent about enrollment in the study and maintaining adequate privacy and confidentiality, all patients were undergoes all the standard pre-operative examination for keratoplasty surgery. Donor corneas were inspected and then trephined. Trephination of recipient corneas will be undertaken and donor corneas was sutured to recipient using 10/0 Ethicon sutures. Patients were discharged after 8-10 days and regular follow up of the patients were maintained as weekly for one month and around every 15 days for next two months. Local instillation of antibiotic and steroids where indicated will be continued with regular check-up of IOP during follow ups.During follow ups post- operative vision, tension, with slit lamp examination for graft clarity, epithelial defect, vascularization, ectasia, suture position and wound leakage, anterior chamber depth, any iris graft synechia were examined.

## Results:-

**Demography:-**

Out of the 50 cases studied, 34 cases were male patients [68%] and 16 cases were female patients [32%].Maximum incidence of cases were in the age group of >60 year both in males and females.

**Table 1:-** Demography

| DIAGNOSIS | 21-40 | 41-60 | >60 |
|---|---|---|---|
| Pseudophakic bullous keratopathy | 00 | 02 | 06 |
| Aphakic bullous keratopathy | 00 | 01 | 01 |
| Leucomatous corneal opacity | 02 | 05 | 04 |
| Adherent leucoma | 00 | 00 | 02 |
| Graft haziness | 01 | 00 | 00 |
| Impending perforation | 00 | 00 | 01 |

**Indication:-**

Most frequent indication for OKP in the study cases was Corneal leucomatous opacities (11/25) [44%], followed by Pseudophakic Bullous Keratopathy [08/25] [32%].

Most frequent indication for TKP in our study was perforated corneal ulcer (15/25) [60%] followed by melted/non healing corneal ulcer [16%] while the rest cases were done for corneal abscess ,perforation with anterior staphyloma and failed TKP.

**Table 2:-** Indication Of Okp.

| DIAGNOSIS | 21-40 | 41-60 | >60 |
|---|---|---|---|
| Melted/Non healing Corneal Ulcer | 02 | 01 | 01 |
| Perforated Corneal Ulcer | 01 | 05 | 09 |
| Perforation with Anterior Staphyloma | 00 | 02 | 00 |
| Corneal Abscess | 01 | 01 | 01 |
| Failed Corneal Graft | 00 | 00 | 01 |

S**tudy Of The Donor Factors**

**Table 3:-** Study Of The Donor Factors

| | **OPTICAL** | **THERAPEUTIC** |
|---|---|---|
| **1)AGE** | | |
| <40 years | 02 | 01 |
| 41 -60 | 10 | 03 |
| >60 years | 13 | 21 |
| **2)CORNEAL CLARITY** | | |
| EXCELLENT | 02 | 00 |
| VERY GOOD | 08 | 04 |
| GOOD | 15 | 12 |
| FAIR | 00 | 08 |
| POOR | 00 | 01 |
| **3)PHAKIC STATUS** | | |
| PHAK1C | 18 | 16 |
| PSEUDOPHAKIC | 07 | 09 |
| APHAKIC | 00 | 00 |
| **4)TIME INTERVAL BETWEEN DEATH & ENUCLEATION** | | |
| 0-4 HR | 10 | 05 |
| 5-10HR | 04 | 19 |
| 11-15HR | 01 | 01 |
| >15HR | 00 | 00 |
| **5)TIME INTERVAL BETWEEN DEATH & SURGERY** | | |
| 0-4 HR | 07 | 03 |
| 5-10 HR | 16 | 17 |
| 11-15 HR | 02 | 04 |
| >15HR | 00 | 01 |

[All the eyeballs were stored in moist chamber at 4 deg C]

The age of majority of donor eyeballs was more than 60 years [68%] or between 41-60 years [26%] {Total: 94%} .There were only 06% eyeballs younger than 40 years. 82% of the donor eyeballs had excellent, very good and good condition. Most of the donor eyes used for OKP were of very good and good condition [92%]. 68 % of the eyeballs were phakic and most of the eyeballs used for optical purpose were phakic [72%].66% of the eyeballs were enucleated within 5-10hrs of death and most of them were utilized within 10 hours [86%].

All of the donor eyeballs were stored in moist chamber at 4 deg C.

**Study Of The Recepient Factors:-**

**Table 4:-** Study Of The Recepient Factors **.**

| Recipient Factors | Optical | Therapeutic ; |
|---|---|---|
| Vision (FC+) | 16 | 4 |
| High intraocular pressure | 00 | 00 |
| Abnormal Sac | 00 | 00 |
| Vascularization | 14 | 08 |
| Pseudophakic/Aphakic | 13 | 06 |
| Systemic Disease | 07 | 05 |
| Nutrition(Fair to poor) | 03 | 03 |

64% of the optical cases had Preop Vision of FC+ while therapeutic cases had PL+ Vision in only 16%.

56% of the Optical cases had vascularization of the host bed and 32% therapeutic cases had vascularized bed. .

Aphakia/Pseudophakia [52%] was another significant finding in Optical cases while same is 32 % in therapeutic keratoplasty.

**Study Of Surgical Factor:-**

**Table 5:-** Study Of The Surgical Factors.

| | OPTICAL | THERAPEUTIC |
|---|---|---|
| **1)EPITHELIUM** | | |
| Scraped | 02 | 00 |
| Intact | 23 | 25 |
| **2)CONJUNCTIVAL PERITOMY** | | |
| Done | 12 | 05 |
| Not Done | 13 | 20 |
| **3)SIZE OF Donor Graft(mm)** | | |
| 7.5 | 13 | 04 |
| 8.0 | 09 | 03 |
| 8.5 | 03 | 07 |
| 9.0 | 00 | 01 |
| 9.5 | 00 | 04 |
| 10.0 | 00 | 04 |
| 10.5 | 00 | 01 |
| 11.0 | 00 | 01 |
| **4)VITREOUS DISTRUBANCE** | | |
| Present | 23 | 22 |
| Absent | 02 | 03 |
| **5)IRIS SURGERY** | | |
| PBI | 15 | 05 |
| No iridectomy | 10 | 20 |
| **6)AC Reformation** | | |
| Air | 21 | 24 |
| Saline | 04 | 01 |

[All surgeries were performed under the operating Microscope]

The donor epithelium was left intact in majority of the cases. [92% - Optical and 100% - Therapeutic]

Conjunctival peritomy was done in 48% of the Optical and 20% of therapeutic cases.

In 88% of the Optical Cases the graft size was 7.5 mm or 8.0 mm (Theoretically the best size graft). 72 % of the therapeutic grafts were larger than 8.0 mm in an attempt to cover the host pathology in Therapeutic cases. In all cases the recipient bed prepared was 0.5 mm smaller than the donor graft.
Vitreous disturbance during surgery were found in total 08% cases of penetrating keratoplasty.

Peripheral button hole Iridectomy was done in 60% cases of OKP while in 20% cases of TKP all the cases.
AC Reformation is done by Air in 90% cases.

**Postop. Complication:-**

**Table 6:-** Study Of Postop. Complications.

| | OPTICAL | % | THERAPEUTIC | % |
|---|---|---|---|---|
| Infection | 05 | 20 | 05 | 20 |
| Wound Problems | 00 | 0 | 00 | 0 |
| Epithelial Defect | 03 | 12 | 05 | 20 |
| Uveitis | 04 | 16 | 03 | 12 |
| Glaucoma | 06 | 24 | 07 | 28 |
| Retrocorneal Membrane | 01 | 4 | 02 | 8 |
| Cataract Formation | 01 | 4 | 07 | 28 |
| Vascularization | 10 | 40 | 12 | 48 |
| Rejection /Failure | 09 | 36 | 08 | 32 |

The most common post-operative complications noticed were Vascularization [44%] Immune rejection [34%] glaucoma [26% ]Uveitis [14%] and infection [20%].
The relative incidence of vascularization and glaucoma was higher in the Therapeutic group.
The incidence of immune rejection on the other hand was marginally higher in the Optical cases [36%] than in the Therapeutic cases [32%].
The incidence of Persistent Epithelial defect was 16% [12% in Optical and 20% in therapeutic cases.
The incidence of cataract formation was 4 % in Optical cases and 28 % in Therapeutic cases.
The incidence of retro corneal membrane was 4% in optical cases and 8% in therapeutic cases. [Overall incidence 6%]

**Probable Cause Of Graft Failure.**

**Table 7:-** Probable Cause Of Graft Failure.

| | **OPTICAL** | **THERAPEUTIC** |
|---|---|---|
| Rejection | 09 | 08 |
| Primary Endothelial Failure | 04 | 06 |
| Complications after Surgery | 12 | 11 |

The most probable causes of failure in Optical and Therapeutic cases were:
1. Complications after surgery [48 % in Optical and 44 % in therapeutic cases]
2. Immune rejection reaction [36 % in optical and 32 % in therapeutic]
3. Primary Endothelial failure [16 % in Optical and 24 % in therapeutic].

## Discussion:-

**Factors Influencing The Survival Of Graft:-**

In our study, the incidence of unfavorable prognostic factors such as vascularization, history of previous cataract surgery and associated systemic disease like DM and HT was high. Wiggin's et-al noted that as high as 69% of the patients with such unfavorable factors had graft failure.

In our study majority of the donors were above 40 years. The average age of the donor eyeball was 65 years and the incidence of Primary endothelial failure was 20% overall; whereas in study conducted by Wiggins et al, the average age of the donor eyeballs was 41 years and the incidence of primary endothelial failure was 0%.Thus, age of the donor eyeball appears to be a major factor in deciding endothelial function.

**Post Operative Complications:-**

The incidence of infectious in our study was 20%; same in the therapeutic [20%] than on optical [20%]. The severity varied from stitch infiltrate to frank corneal ulceration and infection was a direct cause or a contributory factor for failure. In contrast, Tuberville et al reported a 4.9% incidence of infective keratitis after PKP and attributed it to the use of corticosteroids, loose sutures, bandage contact lenses or antecedent herpetic keratitis. The post-operative infections can be a continuation of preoperative microbial keratitis.

The incidence of uveitis in our study was 14%[ 16 % in optical and 12 % in therapeutic].The strong correlation between intraocular inflammation[without any allograft rejection reaction] and graft opacification has been emphasized by Polack FM and he as thought of endothelial failure induced by uveitis as a cause of failure.

Our study showed vascularization in up to 40% in optical and up to 48 % in therapeutic cases, and incidence of rejection was 36% and 32 % respectively.

Paque J and Poirer R noted that neovascularization of the host interface or in the donor graft is associated with a significant increase in the risk of allograft rejection. Mittal et al noted such rejection in up to 50% of the grafts with severe vascularization.This was the cause of failure in 36% of optical and 32 % of therapeutic cases in our study.

Alldredge O. C. et al consider younger age of the recipient as factor increasing risk of rejection. In our study 42 % of patients were younger than 40 years.

Fine M et al reported that inflammatory conditions like Herpetic Keratouveitis or bacterial suppuration from a suture abscess may incite an allograft rejection reaction. In our study, infection and /or inflammation was presenting at least 50 % of the cases.

In our study, the incidence of Glaucoma was 24 % in Optical cases and 28 % in therapeutic cases [overall 26%] and it was directly or indirectly contributory to failure.Mittal reported 66.6% failure rate in patients with post keratoplasty glaucoma. In Arentsen's study, uncontrolled glaucoma was the cause of failure in 20 % of the failed grafts; whereas in Wiggin's study, incidence of glaucoma was 16%.

In all these cases, the pupil was not constricted preoperatively. Also all the patients were on high dose systemic and local steroids. Hughes et al have mentioned the real danger of producing posterior sub capsular cataract due to steroids and have reported the incidence of 19%, similar to our study.

**Causes Of Failure:-**

In our study, the chief causes of failure were complications after surgery [46%], Immune rejection reaction [34%] and primary endothelial failure [20%]; whereas in study conducted by Mittal et al the causes of failure were complications after surgery [71 %] and immune rejection [ 29%]. They did not have a single case of primary endothelial failure and noticed that age of the donor eyeball was not an important factor.

## Summary:-

1. Overall survival rates of the grafts in our study is mainly related to post-operative complications, and proper selection of the donor tissue.
2. Chief causes of Graft failure in our study were:
    1. COMPLICATIONS AFTER SURGERY-46%
    2. IMMUNE REJECTION REACTION-34%
    3. PRIMARY ENDOTHELIAL FAILURE-20%
3. Common post-operative complications in our studying decreasing order of incidence were as follows:
    1. VASCULARISATION: 44%
    2. IMMUNE REJECTION:34%
    3. GLAUCOMA:26%
    4. INFECTION: 20%
    5. UVEITIS: 14%
4. Maximum number of patients belonged to the age >60 years [38%] with male preponderance [2.1:1 ratio] and 76% of them belonged to the lower socioeconomic status. As such, the sense of maintaining proper hygiene and awareness regarding importance of regular follow up and medication in these patients was less which can be an important factor as far as successful graft survival is concerned.

5. Rejection rates are higher in cases where the host bed is vascularized and Conjunctival peritomy could be very much helpful in reducing the incidence of rejection rate in these cases prior to Keratoplasty.
6. Older the age of the donor eyeball, greater is the chances of Primary Endothelial Failure [20% in our study with the average age of the donor eyeball being 65 years].

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