Original Research Article

To study the correlation between donor age and endothelial cell count in donor corneas

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Abstract

Objective: To evaluate the effect of donor age on the endothelial cell density of donor corneas. **Materials and methods:** Corneal endothelial cell density of 245 corneas preserved in McCarey Kaufman {MK} medium was analyzed by konan specular microscope. The donors were divided into three age groups: Group 1 less than 50 years, Group 2 between 51-75 years, Group 3 more than 75 years. **Result:** There were 32 ,108, 132 patients respectively in three groups,theendothelial cell density was found to be higher in donor less than 50 years of age, but endothelial cell counts in donors more than 50 years of age was found to be age independent. **Conclusion:** No cornea should be rejected on age criteria alone.

Keywords: Endothelial cell count, Specular microscopy, Penetrating keratoplasty, Donor cornea, Cornea transplant, Donor age, Hexagonal cells.

Introduction

The importance of corneal grafting is that successful transplantation can restore excellent sight to persons suffering from corneal blindness. Penetrating keratoplasty is the most frequently performed and most successful form of transplantation[1].The proportion of corneal blind persons who could derive long term benefit from corneal grafting depends on the graft transparency. Transparency is affected by many factors. These factors are the type of donor material, condition of the recipient eye, the operative procedures and post-operative treatment.

The function of Endothelial cells of the cornea maintain this tissue in a dehydrated state by their pumping activity, assuring its transparency. The corneal endothelium consists of a single layer of non regenerating predominantly hexagonal cells. It plays a vital role in maintaining a crystal clear cornea by securing a state of relative dehydration of the corneal stroma. At birth the endothelial cell count ranges between 4000 cells/mm^2 and 5000 cells/mm^2 . With aging the cell count will decline to approximately 2000 to 3000 cells/mm^2 in a normal adult eye. A cornea with an endothelial cell count of 500 cells/mm^2 or less is at risk of decompensation, which results in corneal oedema[2]. A minimal numerical density of 400–500 cells/ mm^2 is required to sustain the pumping activity of the endothelium. Endothelial dysfunction results in corneal decompensation and loss of vision.

Specular Microscopy

The first evaluation of the corneal endothelium was by Vogt in 1918[3] He visualized the endothelial mosaic with specular reflection while performing slit-lamp biomicroscopy. For 50 years, this technique was standard-of-care when evaluating the corneal endothelium. In1968, David Maurice developed a microscope to visualize the corneal endothelium and introduced the term specular microscope[4-6].By 1975,

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Ronald Laing had modified the original design to produce a more clinically useful instrument. That same year, Bourne and Kaufman modified the design with a flash attachment and the modern non-contact specular microscope was finally ready for clinical use[7].Davies et al (1976) used electron microscope for judging the endothelial viability[8].

Binder PS (1980) suggested that Specular microscopy can provide urgent information in screening donor corneal tissue to determine suitability for transplantation.

Cornea is graded on the basis of endothelial cell density as :

Excellent: Cell density of > 3000 cells/mm^2

Very good:Cell density of 2500-3000 cells/mm^2

Good: Cell density of 2000-2500 cells/mm^2

Fair: Cell density of 1500-2000 cells/mm^2

Poor: Cell density of 1200-1500 cells/mm^2

Any cell density < 1500 cells/mm^2 should be offered for an absolute emergency only.However, the ultimate responsibility for determining the suitability of the tissue for transplant rests with the medical director and /or transplanting surgeon[9].

Each cell layer item that is observed should be described in terms of degrees, location, type and amount of quantity.

The endothelium assessment is based on following definition:

- **Excellent:** High cell density, cell small and uniform in size and no vacuolated cell.
- **Very good:** High cell density, cell small and uniform in size and few non-central vacuolated cells.
- **Good:** Moderate cell density, cell moderate, and uniform in size and few non-central vacuolated cells or more vacuolated cells evenly distributed over endothelial surface.
- **Fair:** Low cell density, cells larger, and uniform in size and more non-central vacuolated cells or more vacuolated cells evenly distributed over endothelial surface.

Materials and Methods

The study was conducted in the Department of Ophthalmology, MYH Indore from the year 2010 -2012.The corneal endothelial cell density of 245 corneas preserved in McCarey Kaufman {MK} medium was analyzed. The donors were divided into three age groups:

Group 1 less than 50 years
Group 2 between 51-75 years
Group 3 more than 75 years.
Slit lamp evaluation and serological testing was done for all corneas. All corneas were analysed by konan specular microscope. Cornea is graded on the basis of endothelial cell density as :
Excellent: Cell density of > 3000 cells/mm^2
Very good : Cell density of 2500-3000 cells/mm^2
Good: Cell density of 2000-2500 cells/mm^2
Fair: Cell density of 1500-2000 cells/mm^2
Poor: Cell density of 1200-1500 cells/mm^2
Inclusion criteria- only those corneas which were procured within 6 hours of death are used.
Exclusion criteria - corneas of hiv positive and hepatitis b positive patients.

Result

Endothelial cell count of 245 corneas was analysed. Group 1 that is age less than 51 years had 33 corneas. Group 2 that is age 51-75 years has 108 corneas while the third group that is age more than 75 years has 144 corneas. The mean endothelial cell count in group 1,2,3 respectively was 2608.18, 2074, 2034. On analysis we found that endothelial cell density was found to be higher in donor less than 50 years of age, but endothelial cell counts in donors more than 50 years of age was found to be age independent.

Table 1:Donor age and mean endothelial cell count

	Total Corneas	Mean Endothelial Cell Count
Group1(<51 Years)	33	2,608.18
Group 2(51-75 Years)	108	2,074.81
Group 3(>75 Years)	142	2,034.00

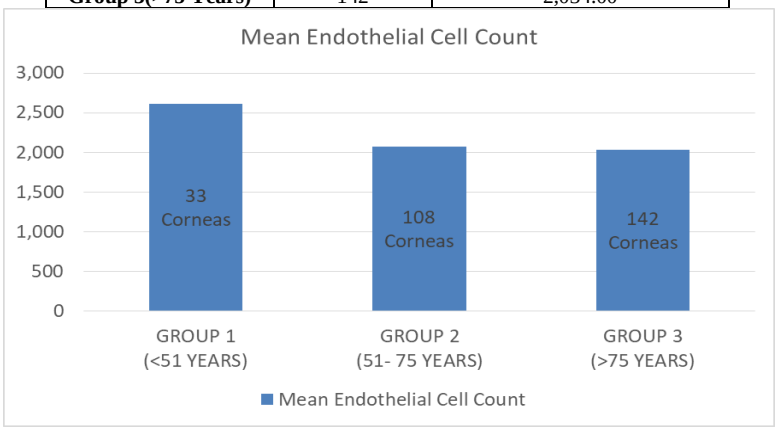

Fig.1: Mean endothelial cell count in various groups

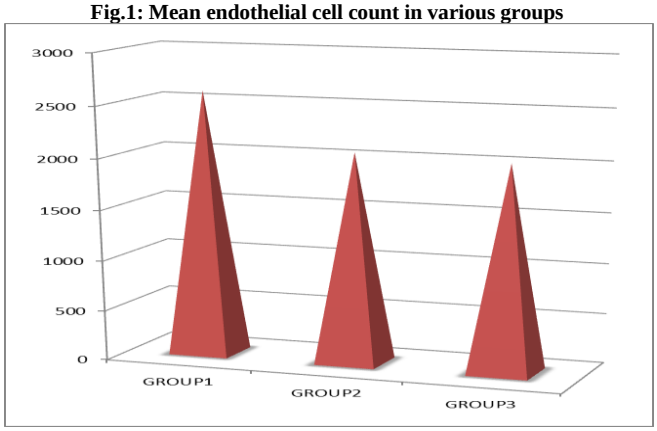

Fig.2:Diagrammatic representation of mean endothelial cell count in various groups

Discussion

Filatov (1935),[10-12]Barraquer (1944) , Venco and Rosso(1948), Paufique et al (1948), and Sourdille (1950) preferred to use eyes from elderly donors probably due to the notion that, older tissues are less reactive and are more likely to be transplanted. Paton (1957)and King (1970) also supported the use of donor material from the aged. However, with the passage of time the importance of corneal endothelium in maintaining the viability of grafts was recognized. Dhanda and Kalevar (1962),(one of pioneering surgeons of India) observed that corneas of elderly people might have subclinical evidence of dystrophies and degeneration even if they appear to be normal to the naked eye, thus affecting the transparency of the graft in due course of time.Kauffmann (1965, 1966) by conducting laboratory studies on fresh human corneas, found that morphological changes in endothelium continue throughout life. Senile age changes like corneal guttata and other corneal degeneration make the cornea of elderly people less suitable for grafting.Dhanda and Kalevar (1972) also performed PK with donor corneas from the age group of

15-45 years. Casey(1972) preferred not to use corneas from young donors because he considered eyes of young children unsuitable because of steep curvature and lack of tissue rigidity. Foster(1970) in his series of 398 recipient eyes, found no significant differences in outcome of corneal grafting due to donor age.Jenkins et al (1979)carried out a comparative study with donor corneas older than 70 years and younger than 35 years old and found a equal percentage of clear grafts in each group over an average follow-up of months.Nahata and Mittal (1983), Bret et al (1990) and Chipman et al (1990) observed no clinical advantage in using cornea from younger donors and believed that graft survival is not dependent of the age of cornea of the donor. Now-a-days, most eye banks and corneal surgeons accept corneal tissue from all donors, infant donors are not preferred because of technical difficulties in using smaller and thinner and more elastic cornea of infants. Most eye banks accept corneas from infant above 6 months of age. Problems relate to both the technical difficulties in using infant tissue and the post-operative complication of postoperative myopia. The extreme thinness of the infant cornea means that it is likely to fold upon itself during handling. This, combined with the small diameter of the cornea, creates problems during the donation surgery, trephining, and during placement and suturing in the host bed. Koenig[15] provides a review of these problems The myopic shift after keratoplasty with infant donor corneas has been related to the steep curvature of these corneas.In our study we found that Endothelial cell count is not directly proportional to donor age and individual variations are possible , and Endothelial cell count was significantly higher in ages less than 50 and thereafter variability was found.

Conclusion

- Specular microscopy is a useful guide to evaluate corneal endothelium.
- In our study, endothelial cell density was found to be higher in donor less than 50 years of age, but endothelial cell counts in donors more than 50 years of age was found to be age independent.
- Endothelial cell count is not directly proportional to donor age and individual variations are possible.

No cornea should be rejected on age criteria alone.

References

Conflict of Interest: Nil
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