Prediction of Visual Outcome after Penetrating Keratoplasty for Pseudophakic and Aphakic Corneal Edema

1Zamani M, MD; 1Panahi Bazaz M, MD; 2Moosavian J, MD; 3Saki A, MS

1Assistant Professor, Ophthalmologist, Jondishapoor University of Medical Sciences, Ahvaz
2Assistant Professor, Ophthalmologist, Jondishapoor University of Medical Sciences, Ahvaz
3MS student in Biostatistics, Jondishapoor University of Medical Sciences, Ahvaz

**Abstract**

**Background and objective:** To evaluate the ability to predict visual outcome after penetrating keratoplasty (PKP) in patients with pseudophakic or aphakic corneal edema (PCE or ACE).

**Material Methods:** Medical records of 34 patients (34 eyes) who underwent PKP for PCE or ACE during 1994-2004 in Ahvaz were retrospectively analyzed for variables in the history and ocular examination before PKP and visual outcome after PKP. The predictive values of preoperative variables, including age, gender, method of intraocular lens (IOL) implantation, vitreous loss during cataract surgery, time interval between cataract and PKP, and history of glaucoma or increased intraocular pressure (IOP) before PKP, on post-PKP visual outcome were assessed using logistic regression analysis. Odds ratio (OR) with 95% confidence interval (95% CI) was calculated for the predictive factors.

**Results:** Mean follow-up was 23.6 months. Best corrected visual acuity (BCVA) of 20/200 or better was achieved in 17 patients (50%). The strongest predictors of the outcome were time interval between cataract surgery and PKP (p=0.008, OR= 3.50, 95% CI; 0.48-31.18), aphakia (p=0.027, OR= 4.29, 95% CI; 0.36-114.8), and no history of glaucoma or increased IOP before PKP (p=0.020, OR= 3.75, 95% CI; 0.71-21.41).

**Conclusion:** In patients with PCE and ACE who are candidates for PKP, time interval between cataract and PKP of less than 20 months, no history of glaucoma or increased IOP before PKP, aphakia versus presence of IOL are associated with a better visual outcome.

© 2015 FADAK PUBLICATIONS All rights reserved.

**Introduction**

Corneal edema after cataract surgery is the most common cause of PKP (1, 2). Despite progress in maintenance of donor cornea, surgical instruments, intraocular lenses (IOL), and techniques of PKP during the last decade, unfortunately, visual outcomes are usually not desirable even after a successful surgery (1, 3). The main causes of this problem are mainly in the macular pathology before surgery or progressive pathology of macula after surgery, glaucoma, and other conditions such as retinal detachment (2). On the other hand, a complete examination of eye is not possible in these patients, often due to corneal edema-induced clouding (1). Techniques such as laser interferometry and potential acuity metery are only partially helpful in determining the prognosis of vision after PKP (4). Therefore, selection of the proper patient and pre-operative consultation to evaluate the visual prognosis after the procedure is difficult. This study was designed to determine the ability to predict visual acuity after PKP in patients with aphakic or pseudophakic corneal edema developed after cataract surgery according to preoperative components.

**Materials and Methods**

This study used the records of patients who were undergone PKP, during 1994-2004 in Ahvaz, due to aphakic or pseudophakic corneal edema after cataract surgery. Patients with follow-up less than 6 months, vitreous and retinal surgery before PKP, or a history of PKP before cataract surgery were excluded. The following variables were investigated and recorded; age, sex, IOL implant, cataract surgery, time interval between cataract surgery and PKP, and history of glaucoma or high IOP before PKP.
effect of these variables on final visual acuity after PKP (predictive value) were analyzed through calculating the odds ratios (OR) and 95% confidence intervals (CI%95) using logistic regression analysis at the significance level of $p>0.05$.

Procedure
All surgeries were performed by two corneal surgeons with the same technique. First, the cornea of recipient was trephined from epithelium and the cornea was detached from the eye with forceps. Then depending on the case, and if necessary, release of posterior and anterior adhesions, removal of membranes behind the cornea or on the iris or IOL, anterior vitrectomy, peripheral iridectomy, excision or replacement of IOL, and pupilloplasty were performed. Then, the cornea of donor was punched at endothelium 0.5 mm larger than the recipient cornea and stitched to the recipient cornea with monofilament 10-0 nylon sutures as 16 separate sutures. From the first postoperative day, antibiotic and steroid drops, and if required, IOP lowering drugs and systemic steroid were administered. Antibiotics usually were stopped within a week and topical steroids were reduced gradually over a few months. The sutures were removed electively after 6 months according to keratometry and topography.

Results
Of 34 patients who underwent PKP due to aphakia and pseudophakia corneal edema, 15 patients (44%) were male and 19 patients (56%) were female. Their mean age was 65.3 years (with an age range of 35-92 years) and they were followed up for averagely 23 months (6-54 months) after surgery. IOL was implanted in 22 cases in the capsular sac or ciliary sulcus and in 7 cases in the anterior chamber. Cataract was operated in 5 patients without IOL implantation. Intraoperative viterous loss and posterior capsule rupture were occurred in 16 patients (47%). Size of all corneas of donors and recipients differed 0.5 mm. They were 7-7.5 mm in 2 cases, 7.5-8 mm in 21 cases, and 8-8.5 mm in 11 cases. The mean donor age was 26 years (2-48 years).

At the end of the second year after surgery, graft survival rate was 82.4%. During follow-up, 3 patients experienced endothelial graft rejection; two of them could not be controlled with medication. The third patient was undergone a second PKP which led again to endothelial graft rejection after 2 months and persistent corneal edema. Finally, cornea was opaque in 6 patients due to uncontrolled glaucoma and intractable increased of IOP in 4 patients (Fig. 1).

![Fig. 1: Graft survival (Kaplan Meier).](image)

After PKP, 3 patients developed non-proliferative diabetic retinopathy (NPDR) and diabetic macular edema, 1 patient developed non-exudative age-related macular degeneration (AMD), and 1 patient developed myopia-induced macular degenerative changes. The cup to disk ratio (C/D ratio) was more than 0.5 mm in 6 patients, all of whom had a history of glaucoma and 4 of them had a previous trabeculectomy. Finally, 16 patients (47%) gained a visual acuity of 20/200 or better (ambulatory vision).

The strongest variables in predicting the final vision of 20/200 or better were time interval between cataract surgery and PKP of less than 20 months ($p=0.008$ and OR=3.50), aphakia ($p=0.027$ and OR=4.29), and no history of glaucoma or elevated IOP ($p=0.020$ and OR=3/75). Age, sex, and vitreous loss during cataract surgery had no significant relationship with the possibility of having final visual acuity of 20/20 or better.

Table 1: The role of preoperative variables on the probability of having a final visual acuity of 20/200 based on logistic regression analysis due to aphakia or pseudophakia corneal edema following cataract surgery.

<table>
<thead>
<tr>
<th>Preoperative variables (Patients number)</th>
<th>OR</th>
<th>CI95%</th>
<th>$P$-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>IOL implantation method (aphakia)</td>
<td>4.29</td>
<td>0.36-114.8</td>
<td>0.027</td>
</tr>
<tr>
<td>Lack of preoperative high IOP or glaucoma</td>
<td>3.75</td>
<td>0.71-21.41</td>
<td>0.020</td>
</tr>
<tr>
<td>Time interval between cataract surgery and PKP shorter than 20 months</td>
<td>3.50</td>
<td>0.48-31.18</td>
<td>0.008</td>
</tr>
</tbody>
</table>

OR: odds ratio
Discussion
Aphakic or pseudophakic corneal edema is a major cause of penetrating keratoplasty in the world and in Iran (1-3, 5). According to the report of the Eye Bank of I.R. Iran, this disease was the third cause of PKP in Iran (5). However, the results of vision are mostly unfavorable (1, 2), mainly due to neovascularization in the recipient cornea, presence of vitreous in the anterior chamber, posterior and anterior adhesions, cystoid macular edema, and high IOP (2, 6). Laser interferometry and potential acuitymetry have qualitative or relatively small quantitative value for predicting the visual outcome after PKP and are only somewhat helpful (4). According to the recent report of Classon et al. from the Eye Bank of Sweden, only 31% of patients with aphakic or pseudophakic corneal edema achieved a vision of 20/40 or better at the end of the second year after PKP (7). The prognosis of PKP in patients with pseudophakic corneal edema and posterior chamber IOL is often good (1, 2). IOL is usually maintained in these patients, but it must be removed or replaced in the following conditions; non-fixed, displaced, or unfitted lens; uncontrolled considerable uveitis; glaucoma; recurrent hyphema; uveitis, glaucoma, hyphema syndrome (UGH); improper IOL such as closed loop or iris supported anterior chamber lens, or posterior chamber lens at anterior chamber with a small depth. In these cases, removal of fibrous tissue around the lens of uvea and restoration of normal anatomy of anterior segment, as well as implant of suitable, fixed IOL without inflammation are of importance (2).
In a study from 1980 to 1992 by Kwartz et al. (3), from 82 PKPs performed on these patients, 36% reported a vision of 20/200 or better. In this study, IOL removal during aphakia-associated PKP significantly increased the probability of graft survival. In the study by Barkana et al. between 1997 and 2000 (1), from 48 PKPs, 13 patients (27%) had a final vision of 20/40 or better and 32 (67%) had a vision of 20/200 or better. The most important variable which was associated with better visual outcome in this study was IOL implantation in capsular sac or sulcus during cataract surgery (1).
In the present study, of 34 cases of PKP, 17 patients (50%) achieved a final vision of 20/200 or better. The patients with a time interval of less than 20 months between cataract surgery and PKP, those with no history of high IOP or glaucoma before PKP, and those with aphakia had a final vision of 20/200 which was 3.5-fold, 3.75-fold, and 4.2-fold higher than other patients, respectively.
The short interval between the two procedures has improved the visual acuity perhaps through decreased infiltration of blood vessels in the edematous cornea, controlling complications such as presence of vitreous in cataract surgical wound, removal of lens from anterior chamber or replacement of a more suitable IOL, and releasing posterior and anterior adhesions (2, 6, 8).
Damage after cataract surgery, especially if it is associated with implantation of lens in the anterior chamber can directly damage trabecular meshwork. Combination of these problems with intraocular inflammation and anterior adhesion often leads to increased IOP and glaucoma (2, 6, 8). Uncontrolled glaucoma per se damages the optic nerve, decreases graft survival, and weakens visual prognosis. Therefore, prior to perform PKP in these patients, it is better to properly select the group of patients who can obtain better visual outcomes.
The present study is a small retrospective research, thus it is recommended to perform a larger, preferably prospective and controlled one. In this way, the Eye Bank can be an appropriate coordinator.

References

DOI: 29