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Cataract Formation After Penetrating Keratoplasty: Clinical Predictors From a 58-Case Retrospective Study in a Tertiary Center

Running title: Risk Factors for Cataract After Penetrating Keratoplasty

Abstract

Purpose:

To identify clinical predictors associated with cataract development after penetrating keratoplasty (PK) in a tertiary referral center and to discuss the implications for surgical planning and postoperative surveillance.

Methods:

We conducted a retrospective analytical study including 58 phakic patients who underwent penetrating keratoplasty at the Ophthalmology B Department of the Specialty Hospital in Rabat, Morocco, with a minimum follow-up of 24 months. The variables analyzed included age, sex, preoperative visual acuity, surgical indication, and average postoperative corticosteroid exposure. Statistical analysis was performed using SPSS 10.0. A p value below 0.005 was considered statistically significant.

Results:

Post-keratoplasty cataract developed in 10 of 58 patients (17.2%). The median age at diagnosis was 55 years (range, 40–70 years), and the mean interval to cataract diagnosis was 18 months, with most cases occurring between 16 and 24 months after surgery. Nuclear cataract was the predominant type (80%), followed by posterior subcapsular cataract (10%) and corticonuclear cataract (10%). Cataract occurred more frequently in eyes operated for corneal dystrophies (44.4%) and healed infectious keratitis (27.2%) than in post-traumatic corneal scars (15.4%) or keratoconus (5%). Advanced age and surgical

indication, particularly corneal dystrophy, were significantly associated with cataract formation, whereas sex, preoperative visual acuity, and cumulative corticosteroid dose were not.

Conclusion:
Cataract is a frequent medium-term complication after penetrating keratoplasty. Older age and the underlying corneal disease appear to be the main predictors in our cohort. Identifying patients at higher risk may help refine postoperative follow-up and inform the choice between sequential and combined surgery.

Keywords:
Penetrating keratoplasty; cataract; risk factors; corneal dystrophy; keratoconus; corticosteroids

Introduction

Penetrating keratoplasty remains an important surgical option for full-thickness corneal disease, despite the expansion of lamellar techniques. Its anatomical and functional results can be compromised by postoperative complications, among which cataract formation is particularly relevant because it may delay visual rehabilitation and require additional surgery. Previous reports have shown that cataract development after PK is not rare, with long-term rates in some series reaching 44% to 64% within 5 years. Older age has consistently emerged as an important predictor, while other reported contributors include preoperative lens changes, associated glaucoma, intraoperative iris manipulation, and

prolonged corticosteroid therapy.

The mechanism of cataractogenesis after PK is likely multifactorial. Surgical trauma, postoperative inflammation, steroid exposure, and altered anterior segment physiology may all contribute. The type of corneal pathology leading to grafting may also influence risk, either through patient age distribution, inflammatory burden, or perioperative complexity. In parallel, the growing shift toward endothelial and anterior lamellar keratoplasty reflects, in part, the desire to reduce complications inherent to full-thickness transplantation.

In this context, identifying the main predictors of cataract after PK remains clinically relevant, especially in centers where PK is still widely performed for infectious, dystrophic, traumatic, and ectatic corneal diseases. The present study aimed to analyze the frequency, timing, and associated factors of cataract development after penetrating keratoplasty in a Moroccan tertiary center.

Methods

Study design and setting

This was a retrospective analytical study performed at the Department of Ophthalmology B, Hôpital des Spécialités, Rabat, Morocco.

Study population

We reviewed the records of 58 patients who underwent penetrating keratoplasty and had a minimum follow-up of 24 months. The study focused on eyes that were phakic at the time of corneal transplantation and in which postoperative lens status could be adequately assessed.

Collected variables

The following variables were analyzed:

- age
- sex

 preoperative visual acuity

 indication for penetrating keratoplasty

 mean postoperative corticosteroid exposure

 timing of cataract diagnosis

 cataract morphology

Outcome measure

The primary outcome was the occurrence of clinically detectable cataract after penetrating keratoplasty during follow-up.

Statistical analysis

Statistical analysis was performed using SPSS 10.0. A p value below 0.005 was considered statistically significant according to the study protocol.

Results

Incidence and timing

Cataract developed in 10 of the 58 included patients, corresponding to an incidence of 17.2%. The median age at cataract diagnosis was 55 years, with a range from 40 to 70 years. The delay before diagnosis ranged from 16 to 24 months after keratoplasty, with a mean interval of 18 months.

Cataract morphology

Nuclear cataract was the most frequent type, observed in 8 of the 10 affected eyes (80%). Posterior subcapsular cataract and corticonuclear cataract each accounted for 1 case (10%).

Sex distribution

Among patients who developed cataract, 7 were women and 3 were men. Although the crude proportion appeared higher in women, sex was not significantly associated with cataract formation in the statistical analysis.

Preoperative visual acuity

Among eyes that subsequently developed cataract, preoperative visual acuity was:

 hand motion in 5 cases

 counting fingers at 1 meter in 4 cases

 1/10 in 1 case

Preoperative visual acuity was not significantly associated with postoperative cataract occurrence.

Indication for penetrating keratoplasty

The incidence of cataract varied according to the initial corneal pathology:

 corneal dystrophies: 4/9 eyes (44.4%)

 infectious keratitis scars: 3/11 eyes (27.2%)

 post-traumatic scars: 2/13 eyes (15.4%)

 keratoconus: 1/20 eyes (5%)

Surgical indication, especially corneal dystrophy, was significantly associated with cataract development.

Corticosteroid exposure

Average postoperative corticosteroid exposure was not significantly associated with cataract occurrence in our series.

Significant and non-significant factors

Factors significantly associated with cataract development:

 older age

 indication for keratoplasty, particularly corneal dystrophy

Factors not significantly associated:

 sex

 preoperative visual acuity

 cumulative corticosteroid dose

Discussion

In this retrospective series of 58 penetrating keratoplasties, cataract developed in 17.2% of eyes within the first 2 postoperative years. This rate falls within the lower range of published estimates, although direct comparison remains difficult because reported incidences vary according to follow-up duration, patient age, lens status at baseline, and the definition of cataract progression. Larger and longer-term studies have reported substantially higher cumulative risks, especially beyond 3 to 5 years.

Our results reinforce the role of age as a major determinant of post-PK cataract formation. This finding is consistent with previous studies showing that older patients are significantly more likely to develop cataract after corneal transplantation. Age likely acts through baseline lenticular vulnerability, but it may also be a surrogate marker of more complex anterior segment status and slower postoperative recovery.

We also found that the surgical indication significantly influenced risk, with corneal dystrophies carrying the highest incidence in our cohort. This result is clinically relevant. Eyes with dystrophic corneal disease are often operated on at an older age than keratoconus eyes, which may partly explain the difference. In contrast, the very low incidence observed in keratoconus is coherent with the younger age and typically clearer preoperative lens status of these patients. This pattern mirrors the broader literature, in which diagnosis and ocular comorbidity influence the risk of cataract formation and subsequent cataract extraction after PK.

Interestingly, corticosteroid exposure was not significantly associated with cataract in our study, despite its frequent implication in the literature. Rathi et al. identified excessive

steroid use and intraoperative iris manipulation as major risk factors, whereas other reports have also suggested a role for postoperative inflammation and glaucoma-related factors.

Our negative finding may reflect the modest sample size, the retrospective nature of the analysis, variability in steroid regimens, or limited power to detect dose-response effects. It should therefore not be interpreted as evidence against a cataractogenic role of corticosteroids in PK patients.

From a practical standpoint, our findings support more individualized postoperative surveillance. Older patients and those undergoing PK for corneal dystrophy appear to deserve closer lens monitoring. This has implications for surgical planning as well. In selected high-risk eyes, especially when early lens changes are already present, the question of combined surgery versus sequential cataract extraction may reasonably be raised. The literature suggests that cataract surgery after PK can achieve good visual outcomes, but it carries specific challenges, including graft protection, endothelial loss, refractive unpredictability, and a definite risk of graft failure.

The present study also has limitations. Its retrospective design exposes it to selection and information bias. The sample size is relatively small, and the 24-month follow-up may underestimate the true cumulative incidence of cataract after PK. Baseline lens grading and some perioperative variables that may affect cataractogenesis, such as iris manipulation or transient postoperative inflammation severity, were not available in a standardized manner. Despite these limitations, this study provides useful real-world data from a tertiary center and highlights the importance of preoperative risk stratification in full-thickness corneal transplantation.

Finally, in the era of lamellar keratoplasty, our results indirectly support the broader trend toward tissue-sparing procedures whenever feasible. By preserving more of the native anterior segment anatomy and reducing intraocular manipulation, lamellar techniques may

lessen some of the mechanisms that contribute to cataractogenesis after PK, although this question depends on the specific keratoplasty type and indication.

Conclusion

Cataract formation after penetrating keratoplasty is a clinically relevant complication that may compromise visual rehabilitation and require further surgery. In our series, older age and the indication for keratoplasty, particularly corneal dystrophy, emerged as the main associated factors. These findings support closer postoperative lens surveillance in high-risk patients and may help guide the choice between sequential and combined procedures. Larger prospective studies with standardized lens assessment are needed to better define the modifiable determinants of post-PK cataract.

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