The predictability and accuracy of IOL calculation in pediatric age group

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Introduction

o The calculation of IOL power can be challenging when dealing with pediatric patients due to several factors:

  o The child's level of cooperation and the need to measure parameters in a supine position.

  o Short axial length (AL).

  o The accuracy keratometry (K) reading.

o It is important to be able to predict if the refractive error (RE) post-operatively is going to match the chosen refractive goal or not.

Aim

We aimed to investigate the factors and predictors that influence the post-operative RE in children undergoing IOL implantation.

Methodology

- Retrospective cross-sectional cohort study.

- The data were collected from two visits, one month after the surgery and two years follow-up.

- **Exclusion criteria**: patient with cataracts due to congenital anomalies, visual impairment, and retinal anomalies, corneal scars, uveitis, persistent fetal vasculature (PFV), and history of ocular trauma, congenital glaucoma, microphthalmia and posterior lenticonus.

- **Calculation of Prediction Error:**
  - **Prediction Error (PE) =** Target refraction- Postoperative refraction.
  - **Absolute prediction error (APE) =** |Target refraction- Postoperative refraction|

Results

- 47 eyes were included.

- The mean age of the patients was 6.52 with a range of 1-15 years.

- 29 (61.70%) eyes had primary IOL implantation and 18 (38.30%) had a secondary IOL.

- The mean of the implanted lens power was 20.31 D.

- The mean of the target refraction was 1.98 D.

- The mean of postoperative refraction was 1.31D and at the last follow up was -0.53 D.

- The mean for the PE was 0.67 and he APE was 1.55 D.

- **AL:**
  - There were a negative correlation between **postoperative refraction and AL**, r= -0.36 (p=0.01).
  - **The AL and the PE** was negatively correlated r= -0.29(p=0.04).

- **Age**: negative correlation was also found between the postoperative refraction and age r=-0.58 (p=0.0001).

- **Calculation method:**
  - A significant negative relationship with **APE** with a coefficient of -1.05 (p= 0.009).
  - **PE** with the coefficient was -1.81(p=0.009).
  - **The postoperative refraction** was significantly influenced with r= -1.8 (p= 0.009).

- **ΔK:** APE was influenced by the Δ K, The coefficient for Δ K was found to be 0.34 (p=0.03).

- Positive correlation was found between the refraction **preoperatively and postoperatively**, r= 0.39 (p= 0.02).

- **The postoperative refraction** was significantly influenced by **the target of refraction** with r=1.04 (p=0.0002)

- **In the last follow up: 8 eyes (17.02%) developed posterior capsular cataract (PCO) after two years of the IOL implantation, while 6 eyes (12.76%) developed pseudophakic glaucoma after more than four years**.

Discussion

The findings of the current Study

- Employing advanced and accurate calculation methods can reduce the occurrence of PE and APE, leading to better refractive outcomes.

- Furthermore, our findings demonstrate that as the axial length and the patient's age approach adulthood, PE decreases, and better postoperative outcomes are expected.

- **The current findings also suggest that ΔK is associated with a larger error in the refractive outcome, highlighting the link between high astigmatism and increased errors in refractive outcomes.**

Discussion

The similarities to the current findings:

- PE mean of 0.24 D, 0.53 D, 0.70 D, and 1.00 D for different formula types and APE means of 1.52 D, 1.58 D, and 1.70 D [1].

- Previous literature indicated that the lack of fixation in children and taking the measurements in spin position with manual IOL calculation leads to less accurate postoperative result[2, 3].

- Many studies reported that IOL calculation methods and formulas are more suitable and based on adult IOL calculations[4-6].

- Other studies suggested that accuracy of K readings have a great impact on postoperative refraction and thus lead to larger errors in refractive outcome[3].

Differences:

- In contrast to the current findings, it has been reported that there was no significant association between age, AL, and horizontal corneal diameter with APE[8].

- Various studies have discussed that the formula of choice had the greatest impact on the post-operative result[8].

- Others concluded that there are no remarkable differences between formulas[9]
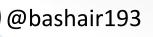
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- Usually, the post-operative refraction is predictable with APE of 1.50 to 1.70 D

- **Yet, the influence of other factors contributing to an increase in error, potentially up to 4.42 D**

- The factors that should be taken into account when choosing the target refraction :
  - The presence of high astigmatism.
  - The patient's preoperative refraction.
  - Their age and AL.
  - How the measurements were obtained.

- Neglecting these factors can potentially lead to increased errors.

- it's essential to recognize that not all these factors can be directly controlled for every patient.

- However, understanding their influence on IOL calculations allows for better management of expectations and the customization of surgical approaches to accommodate individual characteristics.

- **Extended follow-ups are crucial, and further research with diverse subgroups is needed to gain a deeper understanding of the impact of each factor.**

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