Long-Term Results of Traumatic Cataracts in Paediatric Patients

Pediatrik Hastalarda Uzun Dönem Travmatik Katarakt Sonuçları

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ABSTRACT

Purpose: We aimed to evaluate the long-term results of traumatic cataracts in paediatric patients.

Material and Methods: We reviewed the records of 32 paediatric patients who underwent surgery for traumatic cataracts and followed in our clinic between 1985 and 2014. The follow-up period was at least 2 years for each patient. Mean age, gender, cause of trauma, time between trauma and first visit, time between trauma and cataract formation, interval between trauma and cataract surgery, complications and stereoacuity were evaluated.

Results 26 (81.3%) of the cataracts were caused by penetrating injuries. Traumatic cataracts occurred at 5.7±11 days (1–53 days) after penetrating eye injuries and 58.4±89 days (2–210 days) following blunt eye injuries. The mean age at the time of the trauma was 8.8±3.9 years, and the mean age at the time of surgery was 9.9±5.4 years. The mean time of surgery was at 197±620 days following penetrating trauma and 126±205 days after blunt trauma. The mean follow-up was 8.5±6.3 years. Nineteen patients (59.4%) had 100–3000 second/arc stereoacuity with the Titmus and Lang I and Lang II tests.

Conclusions: Traumatic cataract formation began earlier in the patients with penetrating injuries. The localization of the injury and posterior segment trauma were related to final visual acuity. Postoperative vision was statistically significantly improved in terms of stereoacuity.

Key words: Traumatic cataract, penetrating trauma, blunt trauma, stereoacuity.

ÖZ

Amaç: Pediatrik hastalarda uzun dönem travmatik katarakt sonuçlarını değerlendirmek.

Gereç ve Yöntem: Kliniğimizde 1985-2014 yılları arasında travmatik katarakt nedeniyle opere olan ve takip edilen 32 hastanın dosya kayıtları incelenmiştir. Her hasta için takip süresi en az 2 yıldır. Olgular yaş, cinsiyet, travma nedeni, travma ve ilk muayene arasındaki süre, travma ve katarakt gelişimi arasındaki süre, travma ve katarakt cerrahisi arasındaki süre, komplikasyonlar ve stereopsis açısından incelendi.

Bulgular 26 (%81.3) olguda katarakt penetran yaralanma sonrası gelişmiştir. Travmatik katarakt penetran yaralanma sonrası 5.7±11 günde (1–53gün), künt travma sonrası 58.4±89 günde (2–210 gün) oluşmuştur. Ortalama travma yaşı 8.8±3.9 yıl, katarakt cerrahisinin yapıldığı yaş 9.9±5.4 yıl olarak bulundu. Penetran travma sonrası cerrahi 197±620 gün, künt travma sonrası 126±205 günde gerçekleştirilmiştir. Ortalama takip süresi 8.5±6.3 yıldı. 19 olguda Titmus, Lang I ve Lang II testlerinde (59.4%) 100–3000 saniye/arc stereopsis mevcuttu.

Tartışma: Travmatik katarakt gelişimi penetran travmalı olgularda daha erken dönemde gelişmektedir**.** Yaralanmanın yeri ve arka segment travması sonuç görme keskinliği ile ilişkili saptandı. Postoperatif görme keskinliği ile stereopsis düzeyi istatistiksel olarak anlamlı derecede ilişkili saptandı.

Anahtar kelimeler: Travmatik katarakt, penetran travma, künt travma, stereopsis.

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INTRODUCTION

Traumatic cataracts are a notable result of blunt and penetrating eye injuries in adults and children. When caused by a penetrating eye injury, traumatic cataract is the most common reason for vision loss. In developing countries, paediatric traumatic cataracts are a significant reason for blindness.[1-7] Various mechanisms lead to cataract formation. Injury of the lens epithelium causes progressive opacification, and tearing of the lens capsule leads to swift cataract formation. Blunt trauma breaks the integrity of the anterior or posterior capsule and results in cataract.[1] The rate of traumatic cataract between 6 and 15 years of age is 41%.[8] The management of paediatric traumatic cataracts is difficult because of amblyopia and the growth of the eye.[2] Paediatric cataracts may cause low visual acuity, loss of stereopsis, strabismus and blindness.[9] Previous studies have shown good results in paediatric traumatic cataracts if they are managed appropriately.[2] We aimed to demonstrate the effects of time between the initial trauma and cataract formation, as well as the long-term results of paediatric traumatic cataracts.

MATERIALS AND METHODS

The medical records of all paediatric patients who presented with traumatic cataract to the Department of Ophthalmology between 1985 and 2014 were reviewed retrospectively. The study procedures were approved by the institutional review board of the hospital and adhered to the tenets of the Declaration of Helsinki. The records of all the patients were reviewed to identify the patient demographics (age and sex), the involved eye, the mechanism of the injury, the initial and final best-corrected visual acuity (BCVA), the interval between the initial trauma and cataract formation, the interval between the initial trauma and cataract surgery, complications and stereoacuity.

The follow-up period for each patient was at least two years. Globe injuries were classified as penetrating or blunt according to the type of trauma. Penetrating injuries were categorised as central and paracentral according to the location of the trauma. Teller acuity card procedure was used to measure the visual acuity of the children who are under 3years old. Snellen chart and E chart was used to measure the visual acuity of the patients who are older than 3 years. BCVA was defined as the logarithm of the minimum angle of resolution (logmar). Binocular vision was examined using the Titmus test and Lang I and Lang II tests.

Cataract extraction was the second operation after globe repair. Intraocular lens (IOL) implantation was performed in patients who had capsular support and those who were aphakic if capsular support was not available at the time of cataract surgery. Nd:YAG laser capsulotomy was done for posterior capsule opacity (PCO) if posterior capsulotomy was not performed at the time of surgery. Occlusion treatment for amblyopia was carried out after the cataract operation in children less than 10 years of age. A statistical analysis was performed using SPSS (version 22, SPSS Inc., IL). To determine the statistical significance of the qualitative parameters, the chi-square test was used. The Wilcoxon test was used to compare the variables between the groups. The mean values of the continuous variables between the groups were compared using the Mann–Whitney *U* test. The multivariable relationships were analysed using Spearman's rank correlation. All the results were presented as the mean standard error of the mean. $P<0.05$ was assumed to be significant for all the analyses.

RESULTS

Twenty-five (78.1%) of the patients were male, and seven (21.9%) were female. Nineteen (59.3%) patients were injured in their right eyes and 13 (40.6%) injured in their left eyes. The mean age at trauma was 8.8±3.9 years (2–17 years), and the mean age at surgery was 9.9±5.4 years (2–25 years). The mean follow-up period was 8.5±6.3 years (2–25 years). Twenty-six (81.3%) of the traumas were penetrating. The most common trauma cause was sharp metal objects (8 eyes, 25%) in the form of iron wires, and the second most common causes were glass (4 eyes, 12.5%) and knives (4 eyes, 12.5%) (Table 1).

The mean interval between the initial trauma and first examination was 39.5±62 hours while the mean time was 25.7±18 hours (2–72 hours) for penetrating injuries and 105.8±136 hours (1–336 hours) for blunt injuries. Traumatic cataract occurred 5.7±11 days (1–53 days) following penetrating eye injury and 58.4±89 days (2–210 days) after blunt eye injury, with penetrating injuries occurring significantly in the early period compared to blunt injuries ($p<0.004$). The mean time of surgery was 197±620 days (8–3077 days) for penetrating trauma and 126±205 days (6–489 days) for blunt trauma. The difference between the two groups was statistically insignificant ($p=0.680$).

Table 1: *Cause of trauma in pediatric traumatic cataract patients*

Cause of trauma	%	n
Metallic object	25 %	6
Glass	12.5 %	5
Knife	12.5 %	5
Needle	9.4 %	3
Unknown	9.4 %	3
Scissors	9.4 %	3
Toys	6.3%	2
Pencil	6.3%	2
Wood	6.3%	2
Fall	2.9 %	1

n: Number of the patients

The mean BCVA was 2.24±0.9 logmar at the initial examination and 0.41±0.7 logmar at the final examination. The difference between the preoperative and postoperative BCVA was statistically significant (p=0.001). The location of the injury was central in 12 cases (37.5%) and paracentral in 14 cases (43.8%). The mean BCVA was 0.8±1.0 logmar for the central injuries and 0.1±0.3 logmar for the paracentral injuries. The central injuries were linked to poor postoperative visual acuity (p=0.004). The mean postoperative BCVA was 0.4±0.8 logmar for the penetrating injuries and 0.2±0.3 logmar for the blunt injuries. The postoperative BCVA in the patients with blunt trauma were better than those with penetrating trauma; however, this was statistically insignificant (p=0.06) (Figure 1).

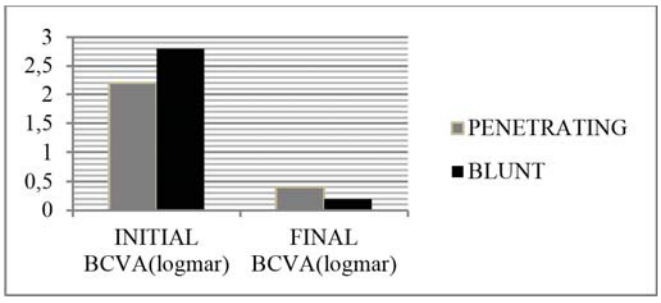

Figure 1: *The postoperative visual acuities (BCVA: Best-corrected visual acuity)*

Twenty-three patients had lens aspiration and posterior chamber IOL implantation (18 in the sulcus and 5 were in bag) ,the mean age of these patients was 9,13±6,5 years (2-25 years), 5 patients had lens aspiration and IOL implantation with anterior vitrectomy and posterior capsulotomy, the mean age of these patients was 11±4,5 years (7-16 years),1 patient had lens aspiration and anterior vitrectomy, the age of this patient was 2 , 2 patients had pars plana vitrectomy (PPV) with lensectomy, the mean age of these patients was 2,5±0,7 (2-3years), and 1 patient underwent PPV with lensectomy and IOL implantation, the age of this patient was 6 . In the lens aspiration and IOL implantation patients, BVCA was 0.215±0.3 logmar while it was 2.4±0.9 logmar for the PPV patients, which was statistically significant (p<0.001). The final BCVA for the patients with IOL implantation and primary posterior capsulotomy was 0,2±0,4 logmar, the final BCVA for the patients with IOL implantation without primary posterior capsulotomy was 0,2±0,3 logmar. Four cases had 3000 second/arc stereoacuity, 6 cases had 200 second/arc stereoacuity, 9 patients had 100 second/arc stereoacuity and 13 cases had no stereoacuity. The final BCVA results were related to stereoacuity: the patients with a good final BCVA achieved stereoacuity (r=641, p=0.001). Age, the type of trauma, the location of the trauma and the initial BCVA were not significantly related to stereoacuity (p=0.853, p=0.785, p=0.38 and p=0.546, respectively). Ten patients had Nd:YAG laser capsulotomy and 5 patients had surgical posterior capsulotomy. Three (9.3%) patients had >1.0 logMAR BCVA, 8 (25%) patients had 1.0–0.3 logMAR BCVA and 21 (65.6%) patients had <0.3 logMAR BCVA.

The target postoperative refraction was +1.0D/ +4.0D depending on patient's age and refractive status of the fellow eye. The IOL power was calculated using the Saunders Retslaff Kraft (SRK)-II formula. The mean final refractive change was -1,53 D during the follow up period. And myopic shift was higher in younger children. The residual refractive error was corrected by spectacles and contact lens. None of our patients needed IOL exchange.

The most frequent complication was corneal opacity, and the second was PCO (Table 2). None of our patients had secondary glaucoma.The final mean intraocular pressure was 13,8±2,6 mmHg. One patient had an ocular foreign body in the retina, which was removed via a pars plana vitrectomy (3.1%). PCO occurred at 1.8±1.2 years; however, 1 patient had PCO at 18 years while the other patient had PCO 7 years after their cataract operation.

Table 2: *Complications during follow-up period*

Complications	%
Corneal opacity	68.7 %
PCO	31.2 %
Pupillary deformation	25.0 %
PAS	18.7 %
Exodeviation	15.6 %
Retinal detachment	9.3 %
Endophthalmitis	6.25 %
Macular scar	3.1 %
Phthisis bulbi	3.1 %

PCO:Posterior capsule opacity, PAS: Peripheral anterior synechiae

DISCUSSION

Traumatic cataract is a common cause of poor visual acuity after ocular injury. In the paediatric population, the management of traumatic cataracts is more complicated because of improvements to the ocular structures and the risk of amblyopia. In our study, the penetrating trauma cases had cataract extraction with IOL implantation as the second operation after globe repair; however, some studies have supported IOL implantation at the time of globe repair.[9,10] Many authors have pointed out that patients who undergo IOL implantation have better visual acuity and binocular vision.[11-12] In our study, traumatic cataract formation was found to be more common in boys, which is in accordance with the literature.[2,4,9,13-24] Reddy et al carried out IOL implantation in the sulcus of 8 patients and in the bag of 14 patients while 2 patients were left aphakic and 6 patients underwent primary posterior capsulotomy.[2] Twenty-three IOLs were implanted in our study: 18 were in the bag and 5 were in the sulcus.

Three patients were left aphakic, and 5 patients required primary posterior capsulotomy.

Eleven (34.4%) patients were younger than 7 years of age, a finding that is compatible with those of previous studies.[4,15,18,25] School-age children are more active and interested in dangerous objects, so it makes them more vulnerable to ocular injuries. The patient's age at the time of the cataract operation could be valuable because of the rapid development of amblyopia in children of younger ages. In the literature, it was observed that older patients were more likely to have better visual results, but this finding was not found to be significant.[2]

We could not establish a relationship between age and final BCVA. There are contradictory findings about visual acuity. Some authors have presented 6/12 or better BCVA in 50–80% of patients.[16,18,25-28] For instance, Adlina et al demonstrated this in 34.4% of their patients, Kumar et al reported 21.1% of their patients and Kinori et al revealed that 10% of their patients had 6/12 or better BCVA.[4,8,20] In our results, 65.6% of the patients had 6/12 or better BCVA.

Xu et al reported that 82.9% of the patients applied to their ophthalmology department within 24 hours of their injuries.[9] Of our patients, 65.6% contacted the Department of Ophthalmology within at least 24 hours of the initial trauma although the patients with blunt injuries applied later than those with perforating injuries. This is thought be related to the acute visual loss that occurs after perforating trauma.

In our study, sharp metallic objects were the most common reason for trauma. Xu et al similarly demonstrated that trauma was most commonly caused by sharp metal.[9] In some studies, wooden sticks were the primary cause of injury,[4,15] however, sports injuries are also frequent: Reddy et al reported that paintball was the most common reason while Kamlesh and Dadeya found that cricket balls were the most common cause of injury.[2,29]

Adlina et al that found the most common cause of visual loss was corneal opacity and amblyopia.[4] Most of the studies we reviewed listed the reasons for poor visual acuity as corneal opacity, amblyopia, retinal detachment, macular scar, traumatic optic neuropathy and secondary glaucoma.[16,18,20,25,28] We also found that poor visual acuity was predominantly related to corneal opacity and PCO. Of our patients, 31.2% had PCO, and 15.6% had posterior capsulotomy at the time of their cataract operations. In Reddy at al's study, the cataract extraction time was 125 days after trauma, and this was not found to be significant for visual outcomes.[2] The time between the original trauma and the cataract operation was similar in our study and, in agreement with the literature, was not significant and was not predictive for visual outcomes. Despite this, there is consensus in many studies about carrying out cataract extraction as soon as possible.[14,30-32] Previous studies have reported that various factors affect the final BCVA. These include first visual acuity, retinal detachment, globe perforation, hyphema, IOL implantation, vitrectomy associated with posterior segment injuries and PCO.[9,11,12,35] In our study, central penetrating injuries displayed the worst BCVA results, with patients who underwent vitrectomy operations having the lowest BCVA.

To predict postoperative refractive outcome is one of the major problem that should be solved by the surgeons in pediatric traumatic cataract patients.[36] Because axial growth, corneal curvature and intraocular lens associated factors are influencing postoperative refractive outcomes.[36] Growing of the eye resulting decreased hyperopia and IOL implantation complicates the matter. Because of the optical reasons IOL implantation causes greater shift to myopia.[37] Surgeons IOL choice is variable. Some surgeons prefer emmetropia or myopia to control amblyopia in early period however some surgeons prefer hyperopia target value depending on patient's age to reduce final myopia.[3]. Our postoperative refractive target was +1.0D/ +4.0D. For the best visual outcomes; axial growth, corneal curvature and intraocular lens associated factors, amblyopia and refraction of the other eye is also very important.[36,37] Rate of refractive growth is higher between 1 and 3 years of age.[38] Dahan and Drusedau suggested undercorrection by 10% to minimize the need for an IOL exchange later in life, when a myopic shift occurs.[39] At the time of IOL implantation the children who are younger attends to develop greater myopic shift.[39,40] In accordance with the literature our younger patients had higher myopic shift. Crouch et al. reported that the mean myopic shift of the children who operated on at 12 months to 2 years of age was -5.96 D, 3 and 4 years of age was - 3.66 D, 5 and 6 years of age was -3.40 D, 7 and 8 years of age was - 2.03 D, 9 and 10 years of age was - 1.88 D, 11 to 14 years of age was - 0.97 D, 15 to 18 years of age was - 0.38 D.[38] Our patients mean surgery time was 9.9±5.4 years and the final postoperative refractive change was -1,53 D in during the follow up period.

The small number of patients and retrospective design are the limitations of our study; however, the follow-up period was long enough to observe complications, final visual acuity and stereopsis. To conclude, traumatic cataract formation began earlier in our study among the patients with penetrating injuries. Furthermore, paediatric patients with traumatic cataract can potentially have good visual and binocular outcomes if the trauma does not include centrally located perforation and posterior segment injury. IOL power, postoperative refractive changes and adjustment of glasses or contact lenses should be performed with careful attention.

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