ETIOLOGİAL FINDINGS AND VISUAL OUTCOMES OF OCULAR INJURIES IN PEDIATRIC PATIENTS

Öz

Amaç: Açıkglob yaralanma (AGY) nedeniyle acil kliniğimize başvuran, tedavi ve takibi yapılan 60 pediatrik olgunun demografik özellikleri ve prognozu etkileyen faktörleri araştırmak.

Yöntem: Kliniğimizde 2010-2021 yılları arasında AGY nedeniyle ameliyat edilip, en az bir yıl takip yapılmış olan 16 yaş ve altı 69 olgunun dosyası toplanmıştı. 

Bu çalışmadı, bir kliniği ziyaret eden 60 pediatrik olguna, anotasyon, ve belge düzenlemeleri yapılmış ve belgelerin dikkatli bir biçimde değerlendirildiği, belgelerin ilgili data'ları, okul, sağlık hizmetleri, ve belgelerin ilgili iletişim kayıtları retrospektif olarak incelendi. Kayıtlardan AGY'nin tipi, oluş nedeni, eşlik eden muayene bulguları, hastaneye başvuru zamanı ile ilk ve son 1. ve 3. visual acuity'si (VA) degerleri, ancak bu tıbbi verileri ve diğer belgelerin ilgili data'ları, incelenmiştir.

Bulgular:

- Olguların ortalama yaşı 11±5 yıl idi. %17,4% kız %82,6%'ı erkek idi. AGY'nin şekli en sık korneal kesi, en sık etiyolojik nedeni kesici aletler (%65,1) idi. Rupture 5.8%, retinal detachment 8.7%, endophthalmitis 2.9%, perforating injury 4.3%. While VA cannot be evaluated in 7% of the cases at the time of admission, it is 0.1 or less in 60%, 0.1-0.6% in 25.7%, and better than 0.6 in 60%. Ocular trauma score (OTS) was 74±16 and pediatric ocular trauma score (POTS) was 64±19. OTS was moderately correlated with follow-up VA (r=0.611, p<0.001) and moderately correlated with baseline VA (r=0.687, p<0.001) [3].

- Olguların başvuru anında %7'sinde GK değerlendirilemezken, %60'ında 0.1 ve daha altında, %25,7'sinde 0.1 ve delici aletler (%65,1) oluşturmaktaydı. Olguların %87'inde sadece bölge 1, %40,6'sında bölge 2, %13'ünde bölge 3 etkilenmişti. Olguların %87'sinde relatif afferent pupil defect (RAPD) vardı. %5,8'ü rüptür, %8,7'si retina dekolma, %2,9'uda endoftalmi, %4,3'ü perforan yaralanma idi. Olguların başvurusu annada %7'sinde GK deberlerinirlemek, %60'ında 0.1 ve daha altında, %25,7'sinde 0.1-0.6, %4,3'ünden ise 0.6'dan daha iyi GK'sa sahipti. Olguların takiplerinde 6. ayda ise %2,9'unda GK deberlerinirlemek (inop), %11,4'de 0.1 ve daha altında, %25,7'sinde 0,1-0.6 ve %60'ında ise 0.6'dan daha iyi GK'sa sahipti. Olguların %87'sinde %60'ında ise 0.6'dan daha iyi GK'sa sahipti. Olguların %87'sinde %60'ında ise 0.6'dan daha iyi GK'sa sahipti. Olguların %87'sinde %60'ında ise 0.6'dan daha iyi GK'sa sahipti. Olguların %87'sinde %60'ında ise 0.6'dan daha iyi GK'sa sahipti. Olguların %87'sinde %60'ında ise 0.6'dan daha iyi GK'sa sahipti. Olguların %87'sinde %60'ında ise 0.6'dan daha iyi GK'sa sahipti.

Conclusion: Even though RAPD cannot be evaluated, OTS is a reliable tool to predict visual prognosis in pediatric OGI.

Keywords: Ocular trauma, blindness, eye injury, penetrating eye injury, childhood eye injury.
Introduction

Childhood eye trauma is a preventable cause of non-congenital visual morbidity.1-3 Considering the life expectancy in children, preventing a globe trauma and knowing the prognostic factors carry a vital risk. If the social aspect of the trauma is also included, there will be the possibility of being emotionally hurt for a lifetime when he/she goes through a difficult experience.2,4,7 Children's experience and competencies are different from adults. Children cannot imagine how much harm they would do to themselves and their environment.8,9 In addition, eye accidents occur more frequently because their motor skills are not fully developed. Therefore, it is important to prevent traumas that can potentially affect children's life and wellness and potentially affect their future.

The distribution of pediatric ocular traumas admitted to the emergency department ranges from self-limiting processes to vision or life-threatening conditions. Like any pediatric examination, the patient's age and underlying behavior can significantly assist with or hinder examination.10-11 The nature of the trauma can vary from self-limiting processes to vision-threatening situations.

Visual acuity (VA) is a vital indicator of the severity of the trauma and it has been stated in previous studies that one of the most important factors determining the prognosis after eye trauma is the VA detected at the first examination, and therefore it should have the highest priority in the evaluation of the pediatric patient.

Ocular trauma scores (OTS) have been developed to predict outcomes and aid in triage of globe injury.11-13 Significant weighting of initial VA may incorrectly bias the ocular trauma score in a pediatric population. Although this scoring system has been accepted in many studies, it can be difficult to evaluate two important criteria in OTS, namely VA and RAPD, especially in traumatized children. This scoring system reduced the emphasis on presenting VA as a prognostic factor and suggested pediatric ocular trauma score (POTS) as an alternative way to predict visual outcome in cases especially where initial VA could not be obtained.13 In this study, we aimed to investigate the demographic characteristics, prognosis and the factors affecting the prognosis of 69 pediatric cases who applied to our emergency clinic due to open eye injury.

Methods

The file records of 69 patients aged 16 years and younger, who were operated for OGI in our clinic between 2010 and 2021, were followed up regularly for at least one year, were reviewed retrospectively. Approval of the local ethics committee of our hospital was obtained for the study (KÜ GOKAEK-2022/02.02).

All patients evaluated in terms of age, gender, date, cause of trauma, location of injury, cause of injury, time to hospital admission, VA at first admission and follow-up, ocular trauma score11 (OTS), pediatric ocular trauma score (POTS) (2× (age + zone) – additional pathologies)13, surgical procedures, zone 1, zone 2, zone 3 according to the injury site, VA of the cases at admission, 1st, 3rd and 6th months (Snellen), surgeries performed in this period, additional surgeries (vitrectomy, lensectomy, evisceration, etc.). All open globe injuries are categorized by the open globe classification system into three anatomical zones.4,11 Zone I includes the cornea and limbus, zone II is 5-mm posterior to the limbus, and zone III, which includes the macula and optic nerve, is posterior to zone II. OTS and POTS were calculated for each patient.11,12 The patients were divided into five groups (higher points are presumed to be better prognosis) based on the trauma evaluation score:

- Group 1: <45 points.
- Group 2: 46–64 points.
- Group 4: 80–89 points.
- Group 5: 90–100 points.

Patients with a history of previous eye surgery were excluded from the study. The data obtained in the study were analyzed using the “SPSS (Statistical Package for Social Sciences) for Windows” package program (Version 20.0., IBM Corp. Armonk, NY, USA). Categorical variables were tested with the Kruskal–Wallis Chi-square test. Spearman Rank Correlation were used to evaluate the predictive value of OTS and POTS on the VA outcome after eye injury. A p-value 0.05 was considered statistically significant.

Results

Demographic characteristics of the participants are given in Table 1. Eighty two percent (n=57) were boys, and the mean age was 11±5 years. Of patients, 35 (50.7 %) were injured in their right eye, 34 (49.3 %) patients were injured in their left eye. While there was no statistical difference in terms of the affected eye, the rate of being affected was significantly higher in males (p=0.708 and p= 0.001, respectively).

Table 1. The clinical characteristics and the treatment of pediatric eye injuries

<table>
<thead>
<tr>
<th>Variables</th>
<th>n*</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Causes of injury</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metal</td>
<td>21</td>
<td>30.4</td>
</tr>
<tr>
<td>Glass</td>
<td>14</td>
<td>20.3</td>
</tr>
<tr>
<td>Wood</td>
<td>14</td>
<td>20.3</td>
</tr>
<tr>
<td>Knife</td>
<td>7</td>
<td>10.1</td>
</tr>
<tr>
<td>Plastic</td>
<td>6</td>
<td>8.7</td>
</tr>
<tr>
<td>Stone</td>
<td>4</td>
<td>5.8</td>
</tr>
<tr>
<td>Pencil</td>
<td>2</td>
<td>2.9</td>
</tr>
<tr>
<td>Wire</td>
<td>1</td>
<td>1.4</td>
</tr>
<tr>
<td>Wound location</td>
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<td></td>
</tr>
<tr>
<td>Zone 1</td>
<td>60</td>
<td>87.0</td>
</tr>
<tr>
<td>Zone 2</td>
<td>28</td>
<td>40.6</td>
</tr>
<tr>
<td>Zone 3</td>
<td>9</td>
<td>13.0</td>
</tr>
<tr>
<td>Admission Time</td>
<td>27±25</td>
<td>7±9 (hours) 27±25 (hours)</td>
</tr>
<tr>
<td>Injury Character</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RAPD</td>
<td>26</td>
<td>37.7</td>
</tr>
<tr>
<td>Rupture</td>
<td>4</td>
<td>5.8</td>
</tr>
<tr>
<td>Retinal detachment</td>
<td>6</td>
<td>8.7</td>
</tr>
<tr>
<td>Endophthalmitis</td>
<td>2</td>
<td>2.9</td>
</tr>
<tr>
<td>Perforating</td>
<td>3</td>
<td>4.3</td>
</tr>
<tr>
<td>Surgery need and complication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PPV</td>
<td>12</td>
<td>17.4</td>
</tr>
<tr>
<td>Cataract Surgery</td>
<td>18</td>
<td>26.1</td>
</tr>
<tr>
<td>Postoperative complication</td>
<td>1</td>
<td>1.4</td>
</tr>
<tr>
<td>Follow-up time (mo)</td>
<td>2±25</td>
<td>27±25</td>
</tr>
</tbody>
</table>

*Total Number of Patients
Follow-up after the initial presentation was made mainly during the outpatient clinic visits. The mean follow-up period was 27±25 months. Of all cases, 85.5% were admitted to the hospital in the first 24 hours. The earliest admission was two hours and the latest was 74 hours after the trauma. The mean admission time was 7.3 (7 ± 9) hours. The most common reported cause of injury was sharp and piercing tools (65.1%). The most common month of injury was determined as October (18.8 %).

While only zone 1 was affected in 87 % of the cases, zone 2 was affected in 40.6% and zone 3 was affected in 13%. Relative afferent pupil defect (RAPD) was present in 37.7% of the cases. 5.8 % were rupture, 8.7% retinal detachment, 2.9% endophthalmitis, 4.3% perforating injury (Table 1).

Relative afferent pupil defect (RAPD) was present in 37.7% of the cases. 5.8 % were rupture, 8.7% retinal detachment, 2.9% endophthalmitis, 4.3% perforating injury (Table 1). While VA could not be evaluated in 7% of the cases at the time of presentation, VA was 0.1 or less in 60%, and 0.1-0.6 in 25.7% and 4.3% had VA better than 0.6. In the sixth month of follow-up, VA could not be evaluated in 2.9% of the cases (inoperable), VA was 0.1 or less in 11.4 %, VA was 0.1-0.6 in 25.7% and better than 0.6 in 60 %. (Figure 1, Table 2).

Figure 1: Relationship between baseline visual acuity and ocular trauma score.

Table 2: Initial and last follow-up visual acuity of patients with ocular injury.

<table>
<thead>
<tr>
<th>Visual Acuity (VA)</th>
<th>Baseline</th>
<th>Last follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>NLP</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>HM (0.001)</td>
<td>26</td>
<td>3</td>
</tr>
<tr>
<td>FC (0.001-0.1)</td>
<td>14</td>
<td>13</td>
</tr>
<tr>
<td>VA=0.1 – 0.5</td>
<td>21</td>
<td>49</td>
</tr>
<tr>
<td>VA≥0.6</td>
<td>5</td>
<td>69</td>
</tr>
</tbody>
</table>

NLP: No light perception; HM: Hand movement; FC: Finger counting.

Traumatic cataract formation was the most common complication in the postoperative period. In addition to primary repair, 26.1% required lensectomy and 17.4% underwent vitrectomy. Intracocular foreign body was present in 4 cases who underwent vitrectomy. PPV was performed in 4 cases due to endophthalmitis and 2 cases were evaluated as inoperable. In the cases whose VA could be evaluated, 6% had rupture, 10% had RAPD, and 3% had perforation. The most common type of injury was zone 1, and the most common tool was sharps. A statistically significant correlation was found between the affected zone and VA (p=0.009). The affected site of injury was a factor influencing visual prognosis. 17.4% of the cases had PPV, 26.1% had cataract surgery, and postoperative complications developed in 1.4%. (Table 1)

The ocular trauma score was 74 ± 16, and the pediatric ocular trauma score was 64 ± 19. Ocular trauma score correlated moderately with VA at baseline (r=0.687, p<0.001) (Figure 1). Median OTS values of patients with VA >0.1 at baseline were 80 (IQR: 80-90), while patients with <0.1 had OTS values of 60 (IQR: 60-70) (p<0.001) (Figure 2) and OTS moderately correlated with VA during follow-ups (r=0.611, p<0.001). (Figure 3) Correlation values of pediatric ocular trauma score was lower (initial VA and r=0.574, p<0.001).

Figure 2: Median OTS values of patients with visual acuity (VA) >0.1 and with <0.1 at baseline

Figure 3: Relationship between last follow-up visual acuity and ocular trauma score (OTS)

Discussion

Ocular penetrating traumas are an important public problem and they cause serious vision loss for the child age group, who will be the future of the country, and increase the health-related financial burden. In addition, open glo injuries that cause serious losses in vision may negatively affect the mental health of the child and family and cause psychological trauma.1,13-16

The main purpose here should be examining the causes of trauma, to raise the parents’ awareness and the precautions, even if they want to protect their children as much as possible, and thus to prevent trauma. In our retrospective study, the epidemiological factors and risk groups that cause OGI in our region, and the factors affecting the prognosis were evaluated. Our pediatric globe trauma population was similar to other reports. In our study, we found a significantly higher rate of ocular injury in boys than in girls, similar to other studies.8, 17-21 This significant difference was similar to the gender difference in adults.22

This result shows that boys are more open to traumas than girls because they are more active, more free, adventurous and curious. In studies conducted with children, the mean age was 10.323, 6.812 and, 9.121, while the mean age in our study was 11 ± 5 years. It was also consistent with the results of the review study by Li X et al.24 When examined according to injury object, Öztürk et al. reported that injuries related to...
metallic objects were more frequent. Similarly, in our study, the cause of trauma was predominantly due to penetrating injury of sharp metal objects (30.4%). In terms of injury site, zone 1 injury was the most common with a high rate in our study (87 %), as in many other studies in the literature. When the literature is scanned, many factors that determine the prognosis of penetrating eye injuries have been identified. Visual acuity, which is the most important among them, followed by wound site and size, presence of relative afferent pupillary defect (RAPD), mechanism of injury, intraocular hemorrhage, lens damage, retinal detachment, presence of intraocular foreign body and endophthalmitis. It is known that the closer the wound end is to the posterior, the worse the prognosis is. It is known that vitreous loss leads to retinal detachment even in the absence of retinal damage rather than trauma.

In our study, severe complications such as 8.7% retinal detachment and 2.9% endophthalmitis, that could seriously affect the VA and prognosis were seen in zone 2 and 3 trauma patients. In terms of the management of complications rather than primary surgery, the need for additional surgery was cataract surgery with 26.1% and PPV with 17.4%. In our study, the effects of OTS and POTS on final VA and prognosis were examined, and while both POTS and OTS were effective, the correlation levels of OTS with final VA were found to be higher. It was found to be superior in guessing. We think that this difference may be due to the lack of initial VA data and the difficulty of obtaining/evaluating RAPD data due to restlessness and difficulty in understanding in children, and that the two methods may be similarly effective.

There are a few limitations in the present study. Due to the retrospective design of our study, it may lead to the possibility of losing patients in follow-up and a lack of outcome data in some identified patients. The sample size was relatively small, and it was not a multicenter study. However, we consider our study results are of representative significance, as research was done in the largest ophthalmological hospital of the region, which receives the majority of the pediatric open globe injuries.

Despite the increase in family education, and preventive measures such as advanced anterior segment and vitreoretinal surgical methods and treatment of amblyopia, eye traumas are still serious public problem. According to our experience, vision loss resulting from ocular trauma in children is possible to be reduced by taking precautions and following appropriate treatment procedures. It was observed that good VA could be obtained with the surgical interventions of the physicians against the traumas as much as the attention of the families.

In conclusion, even though RAPD cannot be evaluated, OTS is a reliable tool to predict visual prognosis in pediatric open globe injuries. Considering various conditions shaping children's lives and their experiences, adapting these conditions to children gain importance in preventing ocular traumas. Because ocular traumas carry the risk of amblyopia in children, unlike adults.

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None

Conflict of Interest

The authors have no conflicts of interest to declare that are relevant to the content of this article.

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Author Contributions

DP: Conception and design; SS, KDK: Data collection; SS, DP: Analysis and interpretation of data; DP, SS: Writing the manuscript; DP, SS, KDK: Critical revision of the manuscript

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