ORIGINAL ARTICLE

Evaluation of Three Ocular Trauma Scores as Prognostic Models in a Cohort of Portuguese Children

Avaliação de Três *Scores* de Trauma Ocular como Modelos Prognósticos numa Coorte de Crianças Portuguesas

Susana Rebocho Duarte [1,2], Maria Leonor Araújo [2], Afonso Lima-Cabrita [1,2], Luís Abegão Pinto [1,2], Mun Faria [1,2], Carlos Marques-Neves [1,2], Filipa Jorge Teixeira [1,2]

[1] Serviço de Oftalmologia, Hospital de Santa Maria, Centro Hospitalar Universitário Lisboa Norte, Lisboa, Portugal
[2] Faculdade de Medicina de Lisboa, Universidade de Lisboa, Lisboa, Portugal

Recebido/Received: 2023-10-15 | **Aceite/Accepted:** 2024-02-18 | **Published online/Publicado online:** 2024-03-11 | **Published/Publicado:** 2024-06-27

DOI: https://doi.org/10.48560/rspo.33247

ABSTRACT

INTRODUCTION: Our purpose was to compare the Ocular Trauma Score (OTS), Pediatric Ocular Trauma Score (POTS) and Modified Pediatric Ocular Trauma Score (MPOTS) as prognostic models of visual outcome after open globe injury in children.

METHODS: Retrospective observational study of pediatric patients with ocular trauma requiring surgical treatment. Between August 2008 and December 2022, pediatric patients who presented to the ophthalmology department at a tertiary referral hospital were included. Children with prior ocular diseases affecting visual function, follow-up < 6 months and no medical record of visual acuity (VA) at 6 months follow-up were excluded. Demographics, mechanism and object responsible for the injury, ocular surgery and logMAR VA at presentation, 6 months, 1 year and 2 years of follow-up was collected. The OTS, POTS and MPOTS were determined. A search for possible predictors of visual outcome was also performed.

RESULTS: In total, 28 eyes of 27 patients (44.4% female, 55.6% male) with a median age of 9 years (3 months - 17 years) were included. Poor visual outcome (final logMAR VA ≥ 1) was found in 9 patients (32.1%). Only 3 patients had complete data to determine the OTS and prognostic evaluation for this score was not performed. Correlation between POTS (n=22) and final VA was statistically significant (*p*-value 0.049), while the correlation of MPOTS (n=22) and final VA was not (*p*-value 0.543). There was not a significant agreement between POTS and MPOTS in predicting poor visual outcome (*p*-value 0.134). Univariable analysis found the following predictors of final VA: wound location (*p*-value 0.027), retinal detachment (*p*-value <0.001) and delay in surgery >48 hours (*p*-value 0.014). Retinal detachment correlated with poor visual outcome (*p*-value 0.026).

CONCLUSION: POTS may be useful in predicting visual outcome after penetrating ocular injury in children, whilst the benefit of MPOTS was not confirmed. OTS may be less practical when evaluating children given the difficulty in obtaining initial VA after open globe injury. Wound location, retinal detachment and delay in surgery (>48 hours) may be good predictors of poor visual outcomes in open globe injury in children.

KEYWORDS: Child; Eye Injuries/diagnosis; Eye Injuries, Penetrating/diagnosis; Prognosis; Trauma Severity Indices.

RESUMO

INTRODUÇÃO: O nosso objetivo foi comparar o *Ocular Trauma Score* (OTS), *Pediatric Ocular Trauma Scor*e (POTS) e *Modified Pediatric Ocular Trauma Score* (MPOTS) como modelos de prognóstico visual após trauma com globo aberto, em crianças.

MÉTODOS: Estudo retrospetivo, observacional, em crianças com trauma ocular com necessidade de cirurgia que se apresentaram no serviço de oftalmologia de um hospital terciário entre Agosto de 2008 e Dezembro de 2022. Critérios de exclusão: antecedentes de doenças oculares que afetassem a acuidade visual (AV), seguimento < 6 meses e ausência de registo da AV aos 6 meses. Foram colhidos dados demográficos, mecanismo e objeto responsável pela lesão, cirurgia ocular efetuada e AV em logMAR à apresentação e aos 6 meses, 1 ano e 2 anos de seguimento. O OTS, o POTS e o MPOTS foram calculados. Foi ainda efetuada uma pesquisa de possíveis preditores da AV final.

RESULTADOS: Foram incluídos 28 olhos de 27 pacientes (44,4% feminino, 55,6% masculino) com uma idade mediana de 9 anos (3 meses - 17 anos). Verificou-se um mau prognóstico visual (AV final em logMAR ≥ 1) em 9 pacientes (32,1%). Apenas 3 casos tinham registos completos para determinar o OTS, pelo que a respetiva avaliação prognóstica não foi efetuada. A correlação entre o POTS (n=22) e a AV final foi significativa (valor-*p* 0,049), enquanto a correlação entre o MPOTS (n=22) e a AV final não foi (valor-*p* 0,543). Não houve concordância entre o POTS e o MPOTS na previsão de mau prognóstico visual (valor-*p* 0,134). A localização da ferida (valor-*p* 0,027), descolamento da retina (valor-*p* <0,001) e atraso na cirurgia >48 horas (valor-*p* 0,014) correlacionaram-se com a AV final. O descolamento da retina correlacionou-se com mau prognóstico visual (valor-*p* 0,026).

CONCLUSÃO: O POTS poderá ser útil na previsão da AV após trama ocular penetrante em crianças, enquanto o benefício do MPOTS não foi confirmado. O OTS poderá ser menos prático na avaliação de crianças, dada a dificuldade na obtenção de AV iniciais após trauma ocular major. A localização da ferida, descolamento da retina e atraso na cirurgia (>48 horas) podem ser bons preditores de mau prognóstico visual após trauma com globo aberto, em crianças.

PALAVRAS-CHAVE: Criança; Índices de Gravidade do Trauma; Lesões Oculares/diagnóstico; Lesões Oculares Penetrantes/diagnóstico; Prognóstico.

INTRODUCTION

Ocular trauma in children is a substantial cause of vision loss and morbidity. In the United Kingdom, 0.7 per 100 000 children are reported to experience serious pediatric ocular trauma each year and up to 280 000 are thought to require hospital admission after ocular trauma throughout the world, annually.[1] Furthermore, ocular trauma accounts for the majority of cases of acquired monocular vision loss in this population.[2] The impact of trauma is greater in children than in adults since, in addition to the direct effects of the eye injury, children's vision is also affected by the consequences of amblyopia. This in turn has lifelong implications, as children with poor vision are more likely to have negative self-perceptions and delayed psychosocial development.

It is important for patients and ophthalmologists to have reliable information to better predict the visual prognosis after a serious eye injury. This led to the development of several ocular trauma score systems, including the Ocular Trauma Score (OTS), which was designed in 2002 by analyzing more than 2500 eye injuries from United States and Hungarian databases.[3] The authors do not specify whether or not children were included. The predictive value of OTS for injuries in adults is widely accepted, whilst it's use in pediatric patients has been questioned, particularly due the difficulty in assessing two of the OTS criteria, namely presenting visual acuity (VA) and positive relative afferent pupillary defect (RAPD), in children, especially after trauma. For this reason, in 2011, Acar *et al* developed the Pediatric Ocular Trauma Score (POTS) based on 28 cases of penetrating ocular injuries in children.[4] They did not include RAPD in the scoring, attributed less importance to the initial VA and suggested an alternative formula for estimating the score in cases where initial VA could not be obtained. Comparisons of OTS and POTS have produced conflicting findings, with some studies favoring OTS[5,6] and others favoring POTS.[7] Both OTS and POTS were constructed to estimate the probability of obtaining a certain visual outcome, which is categorized into five groups ranging from no light perception (NLP) to 20/20. Since this may be too complex for everyday clinical practice, Cohen *et al* recently designed the Modified POTS (MPOTS),[8] which aims to distinguish between favorable and poor visual outcome and requires fewer factors for score calculation. In this study, MPOTS was found to be a better predictor of visual outcome than OTS and POTS in pediatric open globe injuries.

The purpose of this study is to compare the three ocular trauma score systems (OTS, POTS, MPOTS) as prognostic models of visual outcome after open globe injury in children. As a secondary outcome, a search was conducted for factors that might correlate with the visual outcome in this population.

MATERIAL AND METHODS

STUDY DESIGN

This retrospective, observational, cross-sectional study was approved by the local ethics committee at Centro Hospitalar Universitário de Lisboa Norte – Hospital de Santa Maria, Lisboa, and conducted according to the principles of the Declaration of Helsinki. The data was collected by consultation of electronical clinical records and registered in a database with file anonymization.

POPULATION

All patients ≤ 18 years of age with traumatic eye injuries requiring surgical treatment, who presented to the ophthalmology emergency department of Hospital de Santa Maria, between August 2008 and December 2022, were included. Children with prior ocular diseases affecting visual function, follow-up after trauma < 6 months and no medical record of VA at 6 months follow-up were excluded.

STUDY VARIABLES

Clinical records were reviewed on the basis of demographics (age, gender), eye injured, wound location, mechanism and object responsible for the injury, number of ocular surgeries and VA at presentation, 6 months, 1 year and 2 years follow-up. Initial ophthalmologic findings at the time of the first examination included in OTS, POTS and MPOTS scoring system were also collected (Tables 1, 2 and 3). VA was mostly registered in Snellen fraction, while some cases were registered in cycle/cm. These were converted to Snellen fraction, using the Snellen equivalents described in Teller Acuity Cards™ II Handbook.[9] Finally, all VA records were converted to logMAR for statistical analysis.

Wound location was classified according to the open globe classification system[10] in: zone I, involving cornea or corneoscleral limbus; zone II, involving up to 5 mm of sclera from the limbus; zone III, involving more than 5 mm of sclera from the corneoscleral limbus. Whenever multiple corneoscleral injuries existed, the zone was defined as the most posterior opening. Injuries were categorized using the Birmingham Eye Trauma Terminology (BETT) system.[11]

OTS, POTS AND MPOTS CALCULATION

For each score, the raw points for the initial presentation variables were totaled, resulting in raw score sums, which

Table 1. The Ocular Trauma Score variables and raw points (Kuhn *et al* 2002).

Variables	Raw point
Initial visual acuity	
No light perception	60
Light perception/Hand motion	70
1/200-19/200	80
20/200-20/50	90
> 20/40	100
Associated findings	
Globe rupture	-23
Endophthalmitis	-17
Perforation injury	-14
Retinal detachment	-11
Afferent pupillary defect	-10
Sum of raw points	**OTS category**
0-44	1
45-65	2
66-80	3
81-91	4
92-100	5

Table 2. The Modified Pediatric Ocular Trauma Score variables and raw points (Cohen *et al* 2022).

Variables	Raw points
Initial visual acuity	
No light perception	10
Light perception/hand motion	20
Counting fingers	30
0.1-0.5	40
0.6-1.0	50
Wound location	
Zone I	50
Zone II/III	30
Concomitant eye pathologies	
Iris prolapse	-5
Hyphema	-5
Vitreous hemorrhage	-20
Retinal detachment	-20
Endophthalmitis	-30
Sum of raw points	**MPOTS category**
≤30	I
35-65	II
≥70	III
Category	**Risk for poor visual outcome (VA ≤ 20/200)**
I	High
II	Moderate
III	Low

VA, visual acuity

Table 3. The Pediatric Ocular Trauma Score variables and raw points (Acar *et al* 2011).

Variables	Raw point
Initial visual acuity	
No light perception	10
Light perception/hand motion	20
Counting fingers	30
0.1-0.5	40
0.6-1.0	50
Age	
0-5	10
6-10	15
11-15	25
Wound location	
Zone I	25
Zone II	15
Zone III	10
Concomitant eye pathologies	
Iris prolapse	-5
Hyhema	-5
Organic/unclean injury	-5
Delay in surgery (>48 hours)	-5
Traumatic cataract	-10
Vitreous hemorrhage	-20
Retinal detachment	-20
Endophthalmitis	-30
Sum of raw points	**POTS category**
< 45	1
46-64	2
65-79	3
80-89	4
90-100	5

were matched to each score's categories. For the OTS, the score was calculated only for eyes with known initial VA. The POTS and MPOTS were calculated for all patients with open globe injury. For the POTS, whenever initial VA could not be obtained, the following formula (described in the original article[4]) was used to determine the initial raw points: the sum of age plus location of injury points multiplied by two, followed by subtracting points according to the corresponding pathologies. Children >15 years of age were deemed to have the same points as those between 11 and 15. Similarly, for MPOTS calculation, whenever initial VA was not obtainable, an alternative formula proposed by the authors[8] was applied: two times the location of injury, followed by points subtracted according to the corresponding pathologies. To reduce the risk of bias, calculation was carried out for one score system at a time for all cases, and cases were randomized before each score calculation.

STATISTICAL ANALYSIS

Statistical analysis was performed using Microsoft Office Excel 2019 for Windows and the Statistical Package for Social Science (SPSS) version 28.0.0.0.0 (IBM Corp, Armonk, NY, USA). Categorical variables were described using numbers and percentages, and continuous variables using mean ± standard deviation or median and interquartile range (IQR). Correlation between POTS/MPOTS and final VA was assessed using Pearson's correlation coefficient. Cohen's kappa was calculated to evaluate inter-rater agreement between POTS and MPOTS in predicting poor visual outcome (defined as final logMAR VA ≥ 1). Associations between categorical variables were determined using the Chi-square or Fisher exact tests and associations between continuous variables with Pearson's correlation coefficient. To compare postoperative BCVA at 6 months, 1 year and 2 years a Friedman test was performed. A p-value of <0.05 was considered statistically significant.

RESULTS

Overall, 47 medical records were reviewed, of which 20 were excluded for insufficient follow-up (n=16), prior ocular diseases affecting the visual function, namely congenital cataract and keratoconus (n=2), insufficient medical records to calculate score (n=1) and no medical record of final VA (n=1). In total, 28 eyes of 27 patients (44.4% female, 55.6% male) were included. Median age was 9 years (IQR 4-12, range 3 months to 17 years). Mean follow-up duration was 43.3 ± 33.8 months. Only 1 patient had bilateral injury, caused by an airbag. The right eye was affected in 51.9% of patients (n=14) and the left eye in 44.4% (n=12).

In all but 3 patients, initial VA was not evaluated/registered. The remainder had an initial VA of light perception/hand motion. Other clinical characteristics at presentation, such as object responsible for the injury, type of injury (according to the Birmingham eye trauma terminology system), wound location and concomitant pathologies are summarized in Table 4.

Postoperative infection occurred only in 1 patient (3.6%), who developed an infectious keratitis, likely due to a delay in stich removal.

The number of surgeries performed in relation do trauma were as follows: 1 surgery in 35.7% (n=10), 2 surgeries in 39.3% (n=11), 3 surgeries in 7.1% (n=2) and 4 surgeries in 17.9% (n=5). The type of surgery performed is shown in Table 4.

Postoperative logMAR BCVA at 6 months, 1 year and 2 years (Table 5) were similar (p-value 0.311). Univariable analysis found that wound location (p-value 0.027), retinal detachment (p-value <0.001) and delay in surgery >48 hours (p-value 0.014) correlated with BCVA at 6 months, while gender, age group, type of injury, globe rupture, iris prolapse, hyphema, organic/unclean injury, traumatic cataract and vitreous hemorrhage did not. Only retinal detachment was significantly correlated with poor visual outcome (p-

Table 4. Clinical characteristics of injury and surgeries performed.

Object causing injury	
Glass	4 (14.8%)
Stone	3 (11.1%)
Wire	2 (7.4%)
Pencil tip	2 (7.4%)
Sport ball	1 (3.7%)
Airbag	1 (3.7%)
Punch	1 (3.7%)
Doorknob	1 (3.7%)
Other	5 (18.5%)
NA	5 (18.5%)
Type of injury (BETT)	
Penetrating	16 (59.3%)
Rupture	4 (14.8%)
Contusion	4 (14.8%)
IOFB	2 (7.4%)
Lamellar laceration	1 (3.7%)
Wound location	
Zona 1	16 (72.7%)
Zona 2	4 (18.2%)
Zona 3	2 (9.1%)
Concomitant pathologies	
Traumatic cataract	12 (42.9%)
Iris prolapse	8 (28.6%)
Vitreous hemorrhage	7 (25%)
Retinal detachment	5 (17.9%)
Hyphema	5 (17.9%)
Delay in surgery (>48 hours)	4 (14.3%)
Globe rupture	3 (10.7%)
Organic/unclean injury	3 (10.7%)
Endophthalmitis	0
Perforation injury	0
Afferent pupillary defect	0
Type of surgery	
Wound closing	22 (78.6%)
Vitreoretinal surgery	12 (42.9%)
Cataract surgery	9 (32.1%)
Evisceration	1 (3.6%)
Pupilloplasty	1 (3.6%)

BETT, Birmingham Eye Trauma Terminology; IOFB, intraocular foreign body; NA, not available.

value 0.026). Final logMAR BCVA in children with 8 years-old or less was on average 0.68 ± 0.98 and over 8 years-old was 0.95 ± 1.00 (*p*-value 0.500).

Score calculation results for OTS, POTS and MPOTS are presented in Table 6. Only 3 patients (4 eyes) had complete data to determine the OTS, corresponding to the eyes for which initial VA was obtained. Among these, 1 eye was scored in category 2, and the other 3 eyes in category 3. Although a formal analysis was not performed due to the small sample, the visual outcomes of these patients corresponded to the outcomes predicted by the score.

Correlation between POTS (n=22) and final logMAR VA was statistically significant (*p*-value 0.049), with a Pearson's correlation coefficient of -0.425, while the correlation of MPOTS (n=22) and final VA was not statistically significant (*p*-value 0.543). POTS and MPOTS were obtainable in 6 out of 9 cases with poor visual outcome at 6 months. There was no significant agreement between POTS and MPOTS in predicting poor visual outcome (*p*-value 0.134). Comparing the predicted and observed outcomes, POTS classified 7 cases (32%) as category 1. Only 3 of these cases (43%) were found to have poor visual outcome at 6 months. The remainder three patients with poor visual outcome were classified with higher categories, two with category 2 and the other with category 3. For MPOTS, only 1 case (4.5%) was considered as high risk, which did not have a poor visual outcome. Four patients with poor visual outcome were classified in the lowest risk category (category 3) and two was classified as moderate risk (category 2). Overall, POTS accurately predict high risk of poor visual outcome in 50% of the cases (n=3) for which the score applied, although this was not statistically significant (*p*-value 0.267) while MPOTS did not accurately predict any case of poor visual outcome.

DISCUSSION

In children, traumatic ocular injuries frequently result in substantial vision loss. To help predict the visual prognosis, trauma scoring systems were developed, allowing for better communication between healthcare providers. Established scores, such as OTS[3] and POTS[4] still have limitations, especially in children. The newly developed MPOTS8 emerged as simpler score for everyday clinical use. This study aimed to compare these three scores as prognostic models of visual outcome after traumatic injuries in the Portuguese pediatric population.

In accordance with several previous studies,[7,8,12,13] there was a slight male preponderance (56%) in our population of pediatric ocular trauma. Regarding age, some authors report a worse outcome in children <5 years,[14,15] while others found age not to be a predictive factor.[8,13,16] In this study, age was not a significant predictor of visual outcome, not even when comparing amblyogenic (≤ 8 years-old) versus non-amblyogenic age groups (*p*-value 0.500). This may be related to a slower velocity associated with trauma, and hence less severe injuries, in younger patients, as hypothesized by Cohen *et al.*[8]

Traumatic cataract was the most common comorbidity in our cohort, occurring in 43% of eyes, similar to previous studies.[8,17–19] Several authors report lens involvement as prognostic,[18,20] while others report the opposite.[8,16,19] We also did not find traumatic cataract to be a risk factor of poor visual outcome (*p*-value 0.223).

Table 5. **BCVA (Snellen) at 6 months, 1 year and 2 years follow-up.**

Category	BCVA 6 months (n=28)	BCVA 1 year (n=18)	BCVA 2 years (n=19)
No light perception	2 (7.1%)	2 (11.1%)	3 (15.8%)
Light perception/hand motion	2 (7.1%)	3 (16.7%)	1 (5.3%)
Counting fingers	2 (7.1%)	0	0
0.1 - 0.5	13 (46.4%)	6 (33.3%)	4 (21.1%)
0.6 - 1.0	9 (32.1%)	7 (38.9%)	11 (57.9%)
Poor visual outcome (VA ≤ 0.1)	9 (32.1%)	8 (44.4%)	5 (26.3%)

BCVA, best corrected visual acuity; VA, visual acuity.

Table 6. **Category distribution of OTS, POTS and MPOTS.**

Category	OTS (n=4)	POTS (n=22)	MPOTS (n=22)
I	0	7 (31.8%)	1 (4.5%)
II	1 (25%)	4 (18.2%)	6 (27.3%)
III	3 (75%)	8 (36.4%)	15 (68.2%)
IV	0	1 (4.5%)	
V	0	2 (9.1%)	

MPOTS, Modified Pediatric Ocular Trauma Score; OTS, Ocular Trauma Score; POTS, Pediatric Ocular Trauma Score.

Wound location, retinal detachment and delay in surgery (>48 hours) correlated with VA in this cohort. In the published literature, more posterior injuries have strongly been linked to less favorable outcomes,[8,15,16,20,21] while delay in surgery is more frequently reported as non-prognostic.[12,13,22,23] In our study, delay in surgery was due to a delay of parents bringing the child to the emergency department and 2 out of 3 of these patients presented more than 15 days after trauma. Additionally, 3 out of 4 of these cases also had retinal dsetachment. We believe both these factors may explain why this variable was predictive in this sample. Retinal detachment is a well-established risk factor for poor visual prognosis,[8,12,13,16,21,23] a result we also confirmed.

In our cohort, initial post-trauma VA was only available in 4 cases (14%), considerably inferior to other published series that report 16-112 cases (68%-85%).[7,8,12,13] This discrepancy may be related to the inclusion of only cases requiring primary surgical treatment and therefore more severe traumas, for which an initial VA would be comprehensibly more difficult to obtain. Although a formal prognostic analysis was not performed for this score due to this small sample, the authors believe it is important to include these results, since they stress one of the major disadvantages frequently attributed to OTS, especially when evaluating children, also highlighted in previous studies.[7,8]

The POTS model is a more comprehensive evaluation that includes more factors than the OTS model. Although this can also be viewed as a disadvantage of POTS in a practical sense, this score is actually more frequently obtainable than OTS, since it proposes a solution for when initial VA is not obtainable and does not include the evaluation of RAPD. In our cohort, POTS was calculated for 22 cases (79%). The remainder 6 cases were not penetrating traumas. We found this model to be a useful tool, as a whole, in predicting visual outcomes (p-value 0.049), although several parameters were not prognostic individually. Schörkhuber *et al* reported similar results, although favoring OTS for the fewer number of factors required for calculation.[13] Awidi *et al* found POTS to be more predictive of final visual outcomes than the OTS.[7] They also report 7 patients (30%) were eliminated from OTS calculation due to lack of initial VA data. By contrast, Morgan *et al* found no superiority of one score over the other and both OTS and POTS underestimated the potential BCVA after treatment.[24] Bunting *et al* reported a normal distribution of patients through scores 1-5 for OTS but a skewed distribution for POTS, attributable to the inclusion of more patients in POTS category 1, many of whom had a final BCVA better than predicted. They also argue that OTS was designed more rigorously, since several parameters included in the POTS method lack statistical evidence and were validated in a sample of only 27 patients,[4] opposed to the >2500 patients used to estimate the importance of factors included in the OTS method.[3] Additionally, because presenting VA appears to be a key factor in predicting final BCVA,[8,13,18,20–22] estimating outcomes without it may result in prognoses that are too inaccurate.

The recently developed MPOTS model[8] was constructed after analyzing the risk factors for poor visual outcome (VA ≤ 20/200) in 45 children and was subsequently validated in a different cohort of 71 pediatric patients. The suggested scoring system possess the advantage of fewer factors needed for calculation compared to the existing scores. When compared to OTS and POTS, the authors found MPOTS to be superior in predicting poor visual outcome and final VA following pediatric open globe injuries. We did not find MPOTS to be a good predictor for final VA in our sample (p-value 0.543) and there was a lack of agreement between POTS and MPOTS in predicting poor visual outcome (p-value 0.134). Differences in our results regarding prognostic value of POTS *versus* MPOTS may be related to the absence of delay in surgery as a factor in MPOTS, which was found predictive in our study. In addition, MPOTS distributes raw points to less categories than POTS and this may result in less accuracy. Effectively, POTS was found to be a better predictor of poor visual outcome than MPOTS in our study, although correlation was not significant. Overall, both scores underestimated the occurrence of poor visual outcome in our sample. Another important note is that in our cohort these scores were mostly estimated without initial VA, with the alternative formula suggested for each score. Both POTS and MPOTS were predictive for a cohort in which initial VA was available for the majority of cases. It would be relevant to test if both of these scores remain prognostic if only the suggested formula is used for calculation. Otherwise, this proposed advantage may be misleading.

The authors recognize several limitations in this study. First, owing to the retrospective nature of the study, some data observed may have been absent from medical charts. Oppositely, whenever score variables were not specifically mentioned in the records, they were assumed as not present in the case, which can also impact results. Next, the study cohort is small, which may have limited the statistical significance of the analysis. Finally, whenever initial VA was not obtainable, we could not perform the OTS calculation and we were unable to perform a formal prognostic evaluation of this score, as initially aimed. Future larger, prospective studies are warranted to overcome these limitations.

CONCLUSION

This study found that POTS may be a useful tool to predict visual outcome after penetrating ocular injury in children, whilst it did not confirm the benefit of the recently developed MPOTS. In addition, OTS may be less practical when evaluating children given the difficulty in obtaining initial VA scores in a clinical setting such as open globe injury. Wound location, retinal detachment and delay in surgery (>48 hours) may be good predictors of poor visual outcomes in open globe injury in children.

CONTRIBUTORSHIP STATEMENT / DECLARAÇÃO DE CONTRIBUIÇÃO:

Conceptualization – SRD, MLA, AL-C, LAP, MF, FJT; methodology – SRD, MLA; data collection: SRD, MLA; data analysis and interpretation – SRD, AL-C, FJT; original draft preparation – SRD; critical review – MLA, AL-C, LAP, MF, CM-N, FJT; editing – SRD, AL-C, LAP, MF, CM-N, FJT; project supervision – LAP, MF, CM-N, FJT; project administration – FJT.

RESPONSABILIDADES ÉTICAS

Conflitos de Interesse: Os autores declaram a inexistência de conflitos de interesse na realização do presente trabalho.

Fontes de Financiamento: Não existiram fontes externas de financiamento para a realização deste artigo.

Confidencialidade dos Dados: Os autores declaram ter seguido os protocolos da sua instituição acerca da publicação dos dados de doentes.

Proteção de Pessoas e Animais: Os autores declaram que os procedimentos seguidos estavam de acordo com os regulamentos estabelecidos pelos responsáveis da Comissão de Investigação Clínica e Ética e de acordo com a Declaração de Helsínquia revista em 2013 e da Associação Médica Mundial.

Proveniência e Revisão por Pares: Não comissionado; revisão externa por pares.

ETHICAL DISCLOSURES

Conflicts of Interest: The authors have no conflicts of interest to declare.

Financing Support: This work has not received any contribution, grant or scholarship

Confidentiality of Data: The authors declare that they have followed the protocols of their work center on the publication of data from patients.

Protection of Human and Animal Subjects: The authors declare that the procedures followed were in accordance with the regulations of the relevant clinical research ethics committee and with those of the Code of Ethics of the World Medical Association (Declaration of Helsinki as revised in 2013).

Provenance and Peer Review: Not commissioned; externally peer reviewed.

REFERENCES

1. Sii F, Barry RJ, Abbott J, Blanch RJ, Macewen CJ, Shah P. The UK Paediatric Ocular Trauma study 2 (POTs2): demographics and mechanisms of injuries. Clin Ophthalmol. 2018:12-105. doi:10.2147/OPTH.S155611
2. Négrel AD, Thylefors B. The global impact of eye injuries. Ophthalmic Epidemiol. 1998;5:143-69. doi:10.1076/OPEP.5.3.143.8364
3. Kuhn F, Maisiak R, Mann LR, Mester V, Morris R, Witherspoon CD. The ocular trauma score (OTS). Ophthalmol Clin North Am. 2002;15:163-5. doi:10.1016/S0896-1549(02)00007-X
4. Acar U, Tok OY, Acar DE, Burcu A, Ornek F. A new ocular trauma score in pediatric penetrating eye injuries. Eye. 2011;25:370-4. doi:10.1038/eye.2010.211
5. Pahor D, Gracner T. Comparison of the Ocular Trauma Score and Pediatric Ocular Trauma Score as Two Prognostic Models in Pediatric Open Globe Injuries. Klin Monbl Augenheilkd. 2021;238:67-72. doi:10.1055/a-1194-5104
6. Chaudhary A, Singh R, Singh SP. Prognostic value of Ocular Trauma Score and pediatric Penetrating Ocular Trauma Score in predicting the visual prognosis following ocular injury. Rom J Ophthalmol. 2022;66:146-52. doi:10.22336/rjo.2022.29
7. Awidi A, Kraus CL. A comparison of ocular trauma scores in a pediatric population. BMC Res Notes. 2019;12:569. doi:10.1186/s13104-019-4602-8
8. Cohen E, Antman G, Katzburg E, Cohen N, Varssano D, Glatz MM, et al. A modified pediatric ocular trauma score for predicting visual outcome post open globe injury. Graefe's Arch Clin Exp Ophthalmol. 2022;260:3711-8. doi:10.1007/s00417-022-05723-5

9. Teller D, Dobson V, Mayer DL. Conversions from cycles/cm to Snellen equivalents. In: Dobson V, editor. Teller Acuity CardsTM II Handbook. Chicago: Stereo Optical Company; 2005. p.41.
10. Bullock JD, Warwar RE. A system for classifying mechanical injuries of the eye (globe). Am J Ophthalmol. 1998;125:565-6. doi: 10.1016/s0002-9394(99)80206-2.
11. Ferenc K, Morris R, Mester V, Witherspoon CD. Terminology of Mechanical Injuries: the Birmingham Eye Trauma Terminology (BETT). In: Kuhn F, editor. Ocular Traumatology. Berlin:Springer; 2008. p.3-11. doi:10.1007/978-3-540-33825-3_1
12. Bunting H, Stephens D, Mireskandari K. Prediction of visual outcomes after open globe injury in children: a 17-year Canadian experience. J AAPOS. 2013;17:43-8. doi: 10.1016/j.jaapos.2012.10.012.
13. Schörkhuber MM, Wackernagel W, Riedl R, Schneider MR, Wedrich A. Ocular Trauma Scores in paediatric open globe injuries. Br J Ophthalmol. 2014;98:664-8. doi:10.1136/bjophthalmol-2013-304469
14. Farr AK, Hairston RJ, Humayun MU, Marsh MJ, Pieramici DJ, MacCumber MW, et al. Open globe injuries in children: A retrospective analysis. J Pediatr Ophthalmol Strabismus. 2001;38:72-7. doi:10.3928/0191-3913-20010301-07
15. Bunting H, Stephens D, Mireskandari K. Prediction of visual outcomes after open globe injury in children: A 17-year Canadian experience. J AAPOS. 2013;17:43-8. doi:10.1016/j.jaapos.2012.10.012
16. Lee CH, Lee L, Kao LY, Lin KK, Yang ML. Prognostic indicators of open globe injuries in children. Am J Emerg Med. 2009;27:530-5. doi:10.1016/J.AJEM.2008.04.004
17. Thompson CG, Kumar N, Billson FA, Martin F. The aetiology of perforating ocular injuries in children. Br J Ophthalmol. 2002;86:920-2. doi:10.1136/BJO.86.8.920
18. Barr CC. Prognostic factors in corneoscleral lacerations. Arch Ophthalmol. 1983;101:919-24. doi:10.1001/ARCHOPHT.1983.01040010919013
19. Mansouri M, Faghihi H, Hajizadeh F, et al. Epidemiology of open-globe injuries in Iran: analysis of 2,340 cases in 5 years (report no. 1). Retina. 2009;29:1141-9. doi:10.1097/IAE.0B013E3181A395AC
20. Pieramici DJ, MacCumber MW, Humayun MU, Marsh MJ, De Juan E. J. Open-globe injury. Update on types of injuries and visual results. Ophthalmology. 1996;103:1798-803. doi:10.1016/S0161-6420(96)30424-7
21. Tok O, Tok L, Ozkaya D, Eraslan E, Ornek F, Bardak Y. Epidemiological characteristics and visual outcome after open globe injuries in children. J AAPOS. 2011;15:556-61. doi:10.1016/J.JAAPOS.2011.06.012
22. Liu X, Liu Z, Liu Y, Zhao L, Xu S, Su G, et al. Determination of visual prognosis in children with open globe injuries. Eye. 2014;28:852. doi:10.1038/EYE.2014.108
23. Grieshaber MC, Stegmann R. Penetrating eye injuries in South African children: aetiology and visual outcome. Eye. 2006;20:789-95. doi:10.1038/SJ.EYE.6702003
24. Morgan AM, Kasahara N. Comparative Evaluation of the Prognostic Value Between the Ocular Trauma Score and the Pediatric Penetrating Ocular Trauma Score. J Craniofac Surg. 2018;29:1776-9. doi:10.1097/SCS.0000000000004937

Corresponding Author/
Autor Correspondente:

Susana Rebocho Duarte
Serviço de Oftalmologia, Hospital de Santa Maria, Centro Hospitalar Universitário Lisboa Norte,
Praça Nuno Rodrigues dos Santos, 1600-171, Lisboa, Portugal,
E-mail: susanairduarte@gmail.com

ORCID: 0009-0001-1316-0703