1.3 Predicting the Severity of an Eye Injury: the Ocular Trauma Score (OTS)

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1.3.1 Forecasting[1] the Final Outcome of a Serious Injury

A serious eye injury is a major psychological trauma to the patient and family. The most pressing issue for them is to learn about the long-term visual consequence as soon as possible ("Will I go blind?"). Having prognostic information is equally important for the ophthalmologist while he is making triaging decisions (see Chap. 1.8) and as he is counseling the patient (see Chap. 1.4).

1.3.2 Prognostic Information: a Literature Review

Many authors have published studies that have identified variables making the likely outcome of the injury favorable or unfavorable. Unfortunately, much of information in these studies is controversial (Table 1.3.1), and none of the reports present a digital system (i.e., measurable, numerical, objective).

1.3.3 Characteristics of an Ideal Forecasting System

The characteristics of an ideal forecasting system are as follows:

1 Nobel laureate Niels Bohr (1885–1962) once said that "Forecasting is easy… unless it's about the future."

Table 1.3.1 Contradictory prognostic information in the literature. (Modified after [4])

Variables reported both as with and without prognostic significance[a]	Boundary signaling prognostic significance	Surgical interventions reported as either with or without prognostic significance[b]
Age	Anterior vs posterior	No. of operations
Cause of injury	Sclera vs limbus	Prophylactic cryopexy
Endophthalmitis	Limbus vs cornea	Prophylactic scleral buckling
Extent of wound	Limbus vs cornea or sclera	
Facial fracture		Timing of vitrectomy[c]
Hyphema	Cornea vs sclera anterior to muscle insertion	Prophylactic antibiotics[d]
Initial visual acuity		PPV vs tap for endophthalmitis[e]
Injury type		Silicone oil vs gas[e] for PVR
IOFB	Sclera: anterior to vs posterior to muscle insertion	PPV vs external magnet for IOFB
IOFB location		IOL implantation: primary vs secondary
Laterality of eye injured		
Lens injury	Equator	
NLP initial vision	Sclera vs limbus or cornea	
Perforating injury		
Retinal detachment	Sclera, posterior vs scleral	

[a] These variables were determined to have prognostic significance in some studies but to not have any prognostic value in other studies.

[b] "Early" was defined as 3 days in one study [2] and 14 days in another [1]

[c] The type of drug used is important

[d] In posttraumatic infections tap should not be considered as an option [5] (see Chap. 2.17)

Table 1.3.1 *(continued)* Contradictory prognostic information in the literature. (Modified after [4])

Variables reported both as with and without prognostic significance[a]	Boundary signaling prognostic significance	Surgical interventions reported as either with or without prognostic significance[b]
Sex		
Tissue prolapse	Wound length: 2, 3, 4, 5, 6, 9, 10, 11, 12, 15 mm	
VEP, ERG		
Vitreous hemorrhage		
Wound location		

[e]The type of intravitreal gas used is important

- Sufficient data can be collected during the evaluation of the injured person or the initial surgery to allow the prognosis to be predicted.
- The variables used are those that would be part of the normal management process.
- The prognostic information is quantitative rather than qualitative.
- The value is simple and easy to calculate.
- The system is reproducible and reliable.

1.3.4 The Ocular Trauma Score (OTS)

A system that appears to satisfy all criteria described above has been developed using over 2,500 cases from the USEIR [3].[2] Based on one functional

2 Developed by USEIR researchers using a grant from the National Center for Injury Prevention at the CDC

Table 1.3.2 Calculating the OTS and predicting the visual outcome

Step 1: Determining the raw points	Variable	Raw point value
Initial vision	NLP	60
	LP/HM	70
	1/200–19/200	80
	20/200–20/50	90
	≥20/40	100
	Rupture	–23
	Endophthalmitis	–17
	Perforating injury	–14
	Retinal detachment	–11
	APD	–10

Step 2: Conversion of the raw points into the OTS, and identifying the likely visual outcome (%)						
Sum of raw points	OTS	NLP	LP/HM	1/200–19/200	20/200–20/50	≥20/40
0–44	1	74	15	7	3	1
45–65	2	27	26	18	15	15
66–80	3	2	11	15	31	41
81–91	4	1	2	3	22	73
92–100	5	0	1	1	5	94

If none of the five pathologies are present, the visual acuity determines the OTS

(initial visual acuity)[3] and five anatomical (rupture, endophthalmitis, perforating injury, retinal detachment, APD) characteristics, the OTS value is immediately available at the conclusion of the evaluation/initial surgery with reasonably reliable prognostic implications (Table 1.3.2).

1.3.5 Use of the OTS in Clinical Practice

A small card can easily be prepared and carried in the ophthalmologist's pocket. On the front of the card is printed the system to calculate the OTS, and on the back side the visual acuity table. Early clinical experience utilizing the OTS is favorable [6, 7].

Pearl:

One of the benefits of reporting serious eye injury cases to a standardized database (see Chap. 1.7) is that on the USEIR and WEIR websites (www.useironline.org, www.weironline.org) the OTS calculation is immediately available.

DO:

- have the OTS available and use it during counseling and decision-making; it gives more accurate information than visual acuity alone

DON'T:

- imply to the patient that the OTS is specifically for him; rather, that this is statistical information, which may or may not apply in his individual case

Summary

Its is extremely useful for both patient and ophthalmologist to have reliable prognostic information about the injury

3 The most important, albeit not independent, variable

References

[1] Brinton G, Aaberg T, Reeser F, Topping T, Abrams G (1982) Surgical results in ocular trauma involving the posterior segment. Am J Ophthalmol 93: 271–278

[2] Coleman D (1982) Early vitrectomy in the management of the severely traumatized eye. Am J Ophthalmol 93: 543–551

[3] Kuhn F, Maisiak R, Mann L, Mester V, Morris R, Witherspoon C (2002) The Ocular Trauma Score (OTS). Ophthalmol Clin North Am 15: 163–166

[4] Kuhn F, Maisiak R, Mann L, Morris R, Witherspoon C (2002) The Ocular Trauma Score (OTS): Prognosticating the final vision of the seriously injured eye. In: Kuhn F, Pieramici D (eds) Ocular trauma: principles and practice. Thieme, New York, pp 14–12

[5] Mittra RA, Mieler WF (1999) Controversies in the management of open-globe injuries involving the posterior segment. Surv Ophthalmol 44: 215–225

[6] Sarrazin L, Averbukh E, Halpert M, Hemo I, Rumelt S (2004) Traumatic pediatric retinal detachment: a comparison between open and closed globe injuries. Am J Ophthalmol 137: 1042–1049

[7] Sobaci G, Akin T, Erdem U, Uysal Y, Karagul S (2006) Ocular trauma score in deadly weapon-related open globe injuries. Am J Ophthalmol 141: 760–761