

Open Globes in Children: Characteristics, Accuracy, and Prognosis of Computed Tomography Imaging in the Management of Pediatric Open Globe Injuries

Adam J. Cantor, MD
Omar Solyman, MD
Joseph D. Pecha, BS
Kimberly G. Yen, MD

BACKGROUND

- Open globe injury is a sight-threatening ocular emergency requiring urgent surgical management
- Pediatric patients present multiple challenges in prompt diagnosis and management¹
- This study reports computed tomography (CT) characteristics, accuracy, and possible prognostic factors in pediatric open globe injuries

METHODS

- Reviewed 46 charts of patients less than 18 years of age with open globe injuries evaluated at Texas Children's Hospital
- Injuries occurred between June 1, 2010 and June 1, 2020
- Patients either presented directly to Texas Children's Hospital or were transferred
- Performed retrospective analysis to identify patient demographics, injury details, CT findings reported by a neuroradiologist, & outcomes



Figure 1

Neuroradiology correctly reported an open globe of the left eye based on this CT demonstrating a deformed globe and multiple orbital fractures.



Figure 2

Neuroradiology incorrectly reported no open globe in this patient, when in fact the patient was found to have a corneal laceration of the right eye with uveal prolapse.

RESULTS

- 49 globe injuries occurred in 46 patients, 16 female and 30 male
- Average age at time of injury was 7.1 +/- 4.1 (0.6-16.1) years
- Average follow up of 27 months
- 73% of patients with open globes had a CT performed
- CT report accuracy in detection of open globe was 64% (23/35)
- Open globe noted on CT demonstrated increased risk for reduced visual outcome with only 17% achieving visual acuity of 20/40 or better compared to 53% in open globes which were missed on CT report
- Presence of orbital fracture or lens abnormality on CT was associated with worse visual outcomes, with 75% (3/4) and 86% (6/7) respectively having LP or NLP vision at most recent follow up
- No false positive open globes were reported by CT scan
- Repeat open globe injury occurred in 3 patients in this study, of these:
 - One eye had bilateral sequential open globes within 1 year both from blunt trauma and workup revealed a diagnosis of osteogenesis imperfecta
 - Two eyes had a repeat open globe in the same eye
 - Melted corneal ulcer which required PKP which later ruptured at the graft edge due to blunt trauma
 - Rupture with wound dehiscence which required additional repair
- No cases of endophthalmitis nor sympathetic ophthalmia during follow up in this cohort
- Two eyes were enucleated during follow up

Mechanism of Injury

		Visual Acuity After Injury			
		Presenting	First postop	Most recent follow up	
Hit by object	43	Able to read chart	18	14	25
		Count fingers only	4	3	2
Fall	2	Fix and follow	9	10	6
		Hand motion	0	0	3
Attack by animal	1	Light perception or Blink to light	2	4	3
		No light perception	7	6	5
Corneal ulcer melt	1	Unable or not documented	2	6	2
Unknown	2				

DISCUSSION

This study discusses CT findings in pediatric open globes in more detail than any prior study and associates prognostic value to certain findings on CT.

In adult open globes, one study demonstrated a similarly low accuracy of neuroradiologists in interpreting CTs, with of 18 out of 35 (51%) open globes identified correctly.²

Incorporation of CT findings, such as orbital fractures, into ocular trauma scores could improve prognostic accuracy.

CONCLUSIONS/RELEVANCE

CT is a useful tool in diagnosis of ocular and orbital injuries, however open globes may be missed on CT in 1 out of 3 cases.

Open globes with an associated injury on CT scan, such as orbital fracture or lens abnormality, may be associated with a significantly worse outcome.

Although CT scan can contribute information to open globe evaluation, a detailed examination by an ophthalmologist is still the gold standard when clinical suspicion of an open globe based on mechanism of injury is high.

REFERENCES

1. Li, Xintong, et al. Pediatric open globe injury: A review of the literature. *J Emerg Trauma Shock*. 2015;9:216-23.
2. Crowell, Eric. Et al. Accuracy of Computed Tomography Imaging Criteria in the Diagnosis of Adult Open Globe Injuries by Neuroradiology and Ophthalmology. *Academic Emergency Medicine*. Sept 2017;Vol 24, No. 9: 1072-9.