

Ocular Trauma and Guns: The Need for Data

In 2011, fresh from his oculofacial and orbital surgery fellowship at the University of Toronto, Albert Y. Wu, MD, PhD, came face-to-face with firearm-related ocular trauma in a New York City emergency department (ED).

An American man had arranged for a Russian bride to travel to the United States with her daughter. As soon as the wife received her U.S. citizenship, she divorced the husband. “He went off the deep end” and shot them in the head, Dr. Wu recalled. And while both survived, he said, “their eyes and optic nerves were obliterated. The impact shattered their eyes. They ended up with a quality of life no one would want.”

That night was the impetus for his research into gun violence and ocular trauma, said Dr. Wu, now at Stanford University in Palo Alto, California. Yet throughout the last decade, this has proved easier said than done.

Research Roadblocks

Inadequate funding. As Dr. Wu quickly found, no NIH grant support was available, due to funding restrictions.

The lack of federal funding can be partly attributed to legislation, notably what is known as the Dickey Amendment.¹ Although the amendment—which was passed in 1996—explicitly halted funding only for studies that advocate and promote gun control, it

was widely interpreted as blocking all studies of gun-related violence.²

This funding freeze began to thaw when the FY2020 federal omnibus appropriations bill was signed into law on Dec. 20, 2019. With the bill’s passage, \$25 million was designated for research on preventing deaths and injuries from guns, split equally between the NIH and the CDC.³

No registry specific to eye injuries.

Between 1988 and 2003, the United States Eye Injury Registry collected data on 11,360 eye trauma cases of all kinds.⁴ But as Chen et al. recently noted in *Ophthalmology*, the registry—established by the American Society of Ocular Trauma—shut down in 2013.⁵

Although other national trauma databases exist, they typically lack detailed information on ocular findings, including those from a patient’s intake examination in the ED. Chen et al. called for reestablishment of an independent eye trauma registry and pointed out that such a registry would help clinicians and researchers identify “superior evidence-based treatments” and provide better prognostic information to patients.⁵

Studies on Ocular Outcomes

Despite these challenges, researchers have conducted several studies in the last few years.



LESS LETHAL? This patient’s injuries, from a kinetic impact projectile, necessitated enucleation.

A 16-year overview. In 2018, Dr. Wu and his colleagues published a study on the visual outcomes of patients who survived gunshot wounds to the head and were treated at two New York City hospitals during a 16-year period.⁶

The researchers identified 915 affected patients. Of these, 27 (3%) sustained ocular injuries, including orbital fracture, ruptured globe, foreign body, or optic nerve injury. Of the 22 patients whose records were available, 18 survived, and eight of these 18 patients (44%) suffered permanent visual loss in at least one eye to the level of counting figures or worse. “We also found that almost half of the patients with ocular involvement had to have at least one eye removed,” Dr. Wu said.

He added that the study supports the need to create a comprehensive databank on firearms-related injuries, and noted, “We still have so many questions

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to answer, including demographic-based differences in gun trauma treatment, access to ophthalmologists in the ED, and the best treatment protocols for specific wounds.”

The impact on children. In 2019, Weiss et al. evaluated the pattern of firearm-related ocular injuries in young people. They found that more than half of the injuries were associated with traumatic brain injury, and 12.2% of the injuries resulted in death.⁷

For this study, the researchers used data from the National Trauma Data Bank. Of 8,715 firearm-related injuries leading to hospitalization during the study period (2008-2014), 1,972 (22.6%) were in people younger than 21 years of age (mean age 15.2 years).

The most common ocular injuries were open wound of the eye (41.6%) or ocular adnexa (25.5%), orbital injury or fracture (30%), and contusion of the eye or adnexa (21.1%).

The question of “less-lethal” projectiles. Based on their experience with treating patients injured during last year’s racial justice protests in Denver, Prem S. Subramanian, MD, PhD, and his colleagues published a case report⁸ and a subsequent case series and national survey of academic ophthalmology programs⁹ highlighting eye trauma caused by rubber bullets and other kinetic impact projectiles.

In the case report, the patient had a severely ruptured globe with fractures involving the superior, inferior, medial, and lateral orbital walls, along with extensive hemorrhage and extrusion of intraocular contents. After several hours of surgery, the globe was closed anteriorly but had a massive posterior rupture, and the patient underwent enucleation three days later, said Dr. Subramanian, at the University of Colorado in Aurora.

In their larger study, Dr. Subramanian and his research team reported five other individuals with eye injuries from “less-lethal” projectiles, one of whom was blinded in one eye. They also presented data showing that 20% of academic ophthalmology departments responding to their survey—of note, 71% of all programs responded—treated patients with injuries, including

open globes, that were sustained during the 2020 protests.

Studying the Survivors

Gary N. Holland, MD, at the University of California, Los Angeles (UCLA), has had a longstanding interest in the impact of gun violence upon survivors. “I have treated patients with gunshot trauma to the eyes, and I recognize what a profound effect these injuries have on their lives.”

Quantifying morbidity. Dr. Holland recruited Alexander M. Garrett, MD, a third-year emergency medicine resident at UCLA, to work alongside Pradeep S. Prasad, MD, MBA, to initiate a research program on patients treated at Harbor-UCLA Medical Center. A focus of the research, led by Dr. Prasad, is the long-term outcomes of gun-related injuries, including quality of life assessments.

“While there has been an emphasis on mortality related to these injuries, there has been less focus on the public health aspects and individual health outcomes of patients [who survive],” Dr. Garrett said. “It is important to continue studying mortality, but we need to build up the knowledge base on morbidity.”

In an initial quality assessment review, the UCLA team has gathered information including the extent of the injuries at presentation, the procedures that were performed, and, when available, long-term outcomes—all aimed at improving a team approach to the management of these injuries.

Dr. Prasad observed that the work has been challenging because of the lack of standardization in terms of data capture and documentation. “However,” he said, “this is an important first step in terms of our understanding and research planning.”

To date, the team has found that its ocular trauma patients are overwhelmingly young—under age 30, Dr. Prasad said. The injuries themselves can be categorized into either orbital fractures or injuries to the globe, with some patients experiencing both, Dr. Garrett noted.

Describing these outcomes provides an opportunity to identify better surgical interventions for patients, Dr. Prasad said. “It is vital to understand

both the causes of gun violence injuries and the disease burden. We can’t make data-driven decisions without the data.”

1 Omnibus Consolidated Appropriations Act, Pub. L. No. 104-208 (1996). www.congress.gov/bill/104th-congress/house-bill/3610. Accessed Jan. 14, 2021.

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3 Subbaraman N. *Nature*. 2020;577(7788):12.

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7 Weiss R et al. *JAMA Ophthalmol*. 2019;

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8 Ifantides C et al. *Ophthalmol Ther*. 2020;9(3):1-7.

9 Ifantides C et al. *JAMA Ophthalmol*. Published online Dec. 3, 2020.

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