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Research Paper

Eye injuries from electrical weapon probes: Incidents, prevalence, and legal implications

Mark W. Kroll[a,*], Mollie B. Ritter[b], Eric A. Kennedy[c], Nora K. Silverman[d], Roman Shinder[d], Michael A. Brave[e], Howard E. Williams[f]

[a] Biomedical Engineering, University of Minnesota, California Polytechnical Institute, United States
[b] Piedmont Health System, Atlanta, GA, United States
[c] Biomedical Engineering, Bucknell University, Lewisburg, PA, United States
[d] Department of Ophthalmology, SUNY Downstate Medical Center, Brooklyn, NY, United States
[e] LAAW International, LLC, United States
[f] School of Criminal Justice, Texas State University, San Marcos, TX, United States

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ABSTRACT

Purpose: While generally reducing morbidity and mortality, electrical weapons have risks associated with their usage, including burn injuries and trauma associated with uncontrolled fall impacts. However, the prevalence of significant eye injury has not been investigated.

Methods: We searched for incidents of penetrating eye injury from TASER® conducted electrical weapon (CEW) probes via open source media, litigation filings, and a survey of CEW law-enforcement master instructors.

Results: We report 20 previously-unpublished cases of penetrating eye injury from electrical weapon probes in law-enforcement field uses. Together with the 8 previously published cases, there are a total of 28 cases out of 3.44 million field uses, giving a demonstrated CEW field-use risk of penetrating eye injury of approximately 1:123 000. Confidence limits [85 000, 178 000] by Wilson score interval. There have been 18 cases of total unilateral blindness or enucleation. We also present legal decisions on this topic.

Conclusions: The use of electrical weapons presents a rare but real risk of total or partial unilateral blindness from electrical weapon probes. Catastrophic eye injuries appear to be the dominant non-fatal complication of electronic control.

1. Introduction

Electronic control with a conducted electrical weapon (CEW) has broad acceptance with law-enforcement as the preferred less-lethal force option due to its proven injury reduction compared to other control tools. Large prospective studies find subject injury rate reductions of about 65%.[1] This is consistent with a 2/3 reduction in fatal police shootings where CEW usage is not overly restricted.[2] A prospective study found that 5.4% of CEW uses clearly prevented the use of lethal force by police.[3] Of the 310 000 annual CEW field uses, 1 in 3500 is involved in a non-firearm arrest-related death (ARD) vs. the baseline ARD rate of 1:1000.[4] CEWs are also reported as the most effective force option with up to ~75% of uses being effective, from mere presentation, without the need for CEW deployment or discharge.[5]

The short-duration (60–110 μs) electrical pulses applied by CEWs are engineered to stimulate Type A-α motor neurons to control skeletal muscles but with minimal risk of stimulating cardiac myocytes. Effective application of a CEW causes a loss of regional muscle control and can result in an uncontrolled fall to the ground to end a potentially violent confrontation.[6,7]

Despite documented decreases in injuries to suspects, the use of electrical weapons have rare, but significant, risks, including fatalities from falls and burns.[8–10] CEWs launch probes with darts, and, hence, there is a risk of significant eye injury. See Fig. 1. The goal of this paper is to present the risks of such injury and discuss the present warnings and legal decisions.

A CEW has both LASER and fixed aiming sights. The X26 CEW series has a single LASER that approximately aligns with the top probe. The lower probe is launched at a separation angle of 8° below the LASER line as shown in Fig. 2. To obtain significant motor-nerve mediated neuromuscular incapacitation there must be a probe separation of at least 30 cm (12 in) on the front of the body.[6] This required probe spread increases the risk of facial impact and eye injury due to dart penetration and impact from the main probe body (see Fig. 3).

* Corresponding author.
E-mail address: mark@kroll.name (M.W. Kroll).

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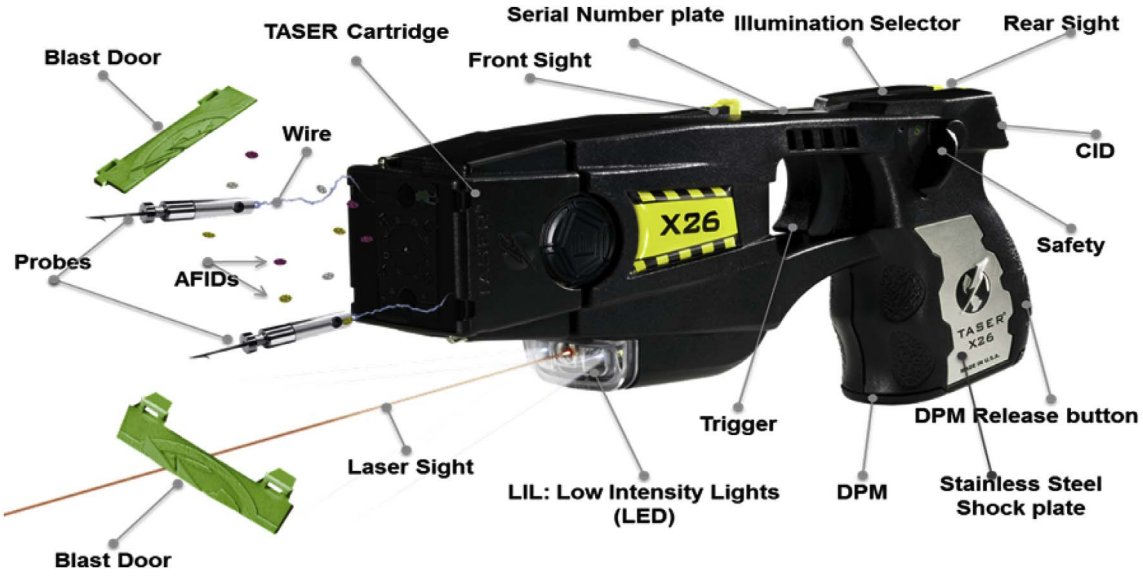

Fig. 1. X26(E) CEW during probe deployment.

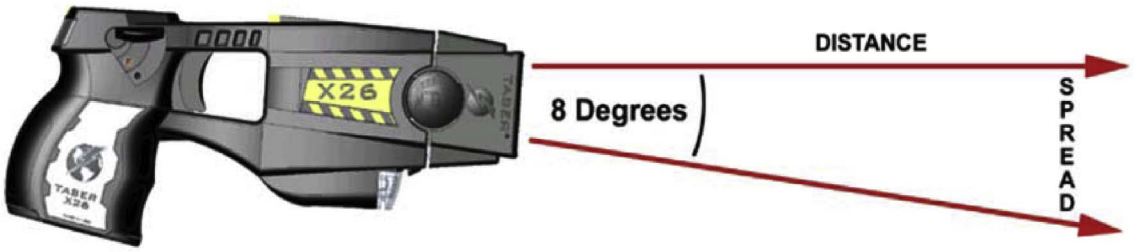

Fig. 2. The lower probe is launched at an angle of 8° below the LASER line.

Fig. 3. Single-shot probe as used in X26 models. Dart portion is 13 mm long; other version has 9 mm dart.

2. Methods

We searched open source media (Google News) and legal databases (Westlaw) for cases of ocular probe penetrations up to 1 Aug 2017. In addition, a survey was sent to 507 Axon (fka TASER) Inc. Master Instructors in the manufacturer's database, and 128 completed the survey. Master Instructors are responsible for the training of the 20 500 certified basic instructors at the various agencies. Larger agencies such as London Metropolitan and Los Angeles Police Departments have their own Master Instructors but smaller agencies share regional ones. These responding instructors covered 52% of CEW-adopting agencies, and we believe that these responders had knowledge of most of the dramatic incidents in those agencies. The results were then cross-referenced to the 12 published injury case reports (comprising 8 globe penetrations and 4 peri-ocular landings of probes) to eliminate duplications (of which there was only 1).

We used the manufacturer's estimate of worldwide field uses for the denominator. The statistical model has been published and the number is updated on their website.[11] The Wilson score interval was used for estimating the binomial proportion confidence interval.

3. Results

We found 20 cases of penetrating eye injury that had not been previously reported in the indexed medical literature. There were 15 from open source media, 3 from legal databases, and 2 from the instructor survey. See Table 1 for the listing. The searches also developed 4 injury cases that did not involve field-use but were due to law enforcement officer and civilian accidents.

Including the 8 previously published cases, there were 28 such injuries out of 3.44 million field uses, giving a demonstrated risk of approximately 1:123 000. Confidence limits [85 000, 178 000] by Wilson score interval. The mean age (for the new cases) was 30.3 ± 11.7 years; combined with the published cases the mean age was 31.1 ± 12.1 years. Both age distributions are consistent with the typical CEW-force recipient according to Strote (32.0 ± 10.7).[12]

In combination with the 8 published case reports we report 12 enucleations and 6 cases of complete blindness and thus the majority (18/28) resulted in a loss of vision. In total there have been 7 cases of partial blindness, and 2 cases of normal vision after successful surgical repair. (There was a case lost to follow-up after a surgical repair attempt.) With 18 identified cases, there is a risk of .64, CI [0.47–0.82] for unilateral blindness or enucleation from a penetrating eye injury, primarily from globe rupture. See Table 2 for summary.