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REVIEW

Taser-Related Ocular Injuries: A Review of the Literature and Medico-Legal Implications

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ABSTRACT

Purpose: Electric weapons have dangers associated with their use, such as burns and trauma related with the impacts of uncontrolled falls, even though they often minimize morbidity and mortality. The exact visual outcome of the damage inflicted is unknown, even though numerous studies have been documented in the literature about the ocular damage induced by the use of these tools.
Methods: We present a narrative review of types of eye damage associated with the use of the Taser. The following search terms were used to identify eligible articles through the PubMed database: "TASER", "Conducted Electric Weapons", "CEWs".
Results: A total of 15 articles were included with information about 38 patients with eye damage associated with the use of taser. The majority of patients were males. In most cases the mechanism of injury was the penetration of the probe inside the eye. Clinical manifestations of ocular damage were present in only 18 out of 38 cases and varied according to the type of damage mechanism. Indeed, the cases in which the probe had penetrated the eye showed more severe clinical manifestations with a poor visual outcome.
Conclusion: In conclusion, the introduction of taser use for law enforcement requires serious consideration and adequate training for officers.

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INTRODUCTION

The term "TASER" refers to a device currently produced by Axon Enterprise Incorporated and is an acronym for Thomas A. Swift Electric Rifle.[1] TASERs are a type of Conductive Electrical Weapon (CEW) that was primarily developed for use by law enforcement organizations in situations where the use of lethal weapons, such as guns, would put police or other people at risk.[2] As the only such weapon capable of causing involuntary muscular incapacitation, conducted electrical weapons (CEWs) are the law enforcement officer's chosen intermediate-force alternative.

The first taser conducted energy weapon was introduced in 1993 as a less-lethal alternative to firearms for subduing fleeing, combative, or potentially dangerous individuals who would have otherwise been subjected to more lethal force options, such as firearms. According to Alpert et al., over 15,000 law enforcement and military agencies used tasers as part of their continuum of use of force.[3] It was authorized for use in Italy in January 2020 although law enforcement agencies, following training, began using it from March 2022.

TASERs are intended to deliver electrical energy to a subject in two different ways (drive stun and probes), causing the subject to feel discomfort from the contraction of their muscles as well as maybe some pain.[4]

In drive stun mode, the person is hit with the TASER's head directly, sending an electrical charge through their skin and flesh. A burn could develop from the arcing charge's transfer of heat and light to the impact's surface. The electricity is contained between two or more electrodes because the electrical discharge is of the arcing kind.[5,6]

In probe mode, the patient is given electrical energy at a distance using probes that are housed on the TASER's cartridge and connected to it by two wires.[4]

TASER International became a publicly traded company in 2001, and renamed itself Axon in 2017.

Axon introduced the TASER 10 model on January 24, 2023, showing multiple new features and enhancements. The updated de-escalation capabilities now incorporate several enhancements, including a 1,000-lumen pulsating light, loud aural alarms, and LASER painting. These additions serve to warn an individual to comply with instructions before resorting to the deployment of probes. The extended range now reaches up to 45 feet, as opposed to the former limit of 25 feet. This allows for increased decision-making time and space, thereby minimizing danger for all parties involved. The current version has the capacity to deploy up to 10 probes, which is an improvement from the earlier models that could only deploy two or four probes.

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The TASER's trigger is pressed, pushing the probes toward the target until they pierce the person's skin and complete the circuit needed to transfer electrical energy.[7] Moreover, the darts are capable of penetrating clothing and, upon making contact with the target, delivering an electric charge that temporarily incapacitates the target by disrupting the nervous system. This ability can be used as often as needed to maintain immobilization. Tasers have been demonstrated to effectively immobilize offenders 82% of the time.[8,9]

In the US, the first report on the incidence of injuries associated with Tasers showed an 11% rate associated with the use of Conducted Electric Device or Taser.[10] Contusions, abrasions, and lacerations occur in approximately 38% of patients, mild rhabdomyolysis in 1%,testicular torsion in .5%, Sterility in men .5% are the most frequent complications and the mortality rate associated with taser is 1.5%.[11] However, increasing numbers of cases of ocular injury resulting from taser use are reported in the scientific literature.

A recent analysis using the Wilson score interval method has estimated the chance of penetrating eye injury to be 1 in 123,000, with confidence limits ranging from 85,000 to 178,000.[12]

For these reasons, the purpose of this review is to determine which are the most frequent causes of injury in cases of eye involvement, their severity, outcomes and, finally, to provide an analysis also from a forensic perspective.

MATERIALS AND METHODS

A narrative review of types of eye damage associated with the use of the Taser was performed. The following search terms were used to identify eligible articles through the PubMed database: "TASER", "Conducted Electric Weapons", "CEWs"and "ocular complications or ocular injuries or eye trauma or cataract or glaucoma or retinal detachment or intraocular hemorrhage of visual acuity or intraocular pressure or ophthalmologic treatment.

The search was limited to articles written in English, published from January 2004 up until the search was performed (November 2023), and no other filters were applied. Manuscripts that did not analyze ocular damage associated with the use of a taser were excluded.

Two researchers (G.A and F.G) performed data extraction from the included articles and reported the results in an Excel worksheet. One author (G.A.) extracted data from the included studies, and the second author (F.G.) checked the extracted data. Disagreements were resolved by a consensus-based discussion between the two review authors (G.A. and F.G.); if agreement could not be reached, a third author (M.M.C.) was scheduled to intervene.

RESULTS

Selection of the Studies

A total of 12 articles were included in the narrative review.[12–23] Manual search among the cited references from the articles retrieved in the first round of search provided additional three references.[24,25] The full text of the total of 15 articles was examined in detail.

Description of the Selected Studies

According to the search terms and manual search through references, 12 publications were retrieved. The results of our review are reported in Table 1 in chronological sequence. All the papers were published between 2005, and November 2021.

Most papers were case reports (12/15), followed by case series (2/15) and a letter to the Editor (1/15). From the 15 papers, information about 38 patients with eye damage associated with the use of taser, of these the majority of patients were males (89.5%). In 13 papers the age of the patients was reported, of these the average age was 30.6 years.

Mechanism of Injury

In most cases the mechanism of injury was the penetration of the probe inside the eye (30/38). In four cases, however, the probe had penetrated inside the eyelid. In a further three cases the probe had penetrated the medial canthus (1/38), the zygomatic bone (1/38) and the previously implanted ocular prosthesis (1/38). Finally, in one case the damage to the eye had not been caused by direct penetration but, indirectly, by the electroshock caused by the taser discharge.

Ocular Findings

Clinical manifestations of ocular damage were present in only 18 out of 38 cases and varied according to the type of damage mechanism. Indeed, the cases in which the probe had penetrated the eye showed more severe clinical manifestations such as vitreous hemorrhage,[13,14,24] retinal penetration,[13] retinal hemorrhages,[15,17,22] retinal detachment,[14,17] uveal tissue involvement,[16,23] pupil distortion,[25] hyphema[20,25,26] and globe rupture.[24]

Twelve taser-injured patients received enucleation surgery because their condition prevented vision recovery. Surgery was performed on 25 patients to try an anatomical and functional recovery or to eliminate any remaining taser. Only one patient needed both medical and parasurgical care. Functional improvement was typically poor. Cases involving only the median canthus and zygomatic bone had no impact on vision and only needed oculoplastic surgery.

The overview of the individual cases is shown in Table 1.

DISCUSSION

To the best of our knowledge, this review includes all patients who have experienced ocular involvement following the use of tasers since their introduction in law enforcement. The introduction of tasers for law enforcement is a highly debated and controversial topic. On one hand, some argue that the use of tasers could be a less lethal alternative to other weapons used by police, such as guns.[27] On the other hand, there are many concerns regarding the safety of using tasers, especially towards individuals who may be more vulnerable, such as

Table 1. Full list of all articles highlighting taser-related ocular injuries.

Author, Year	Type of article	Nr. of patients	Age	Sex	Mechanism of Injury	Type of ocular damage	Visus post-correction	Treatment
Ng W. et al. (2004)	Case Report	1	50	M	Probe penetration	Retinal penetration, subconjunctival and vitreous haemorrhage, and involvement of the inferior rectus muscle	20/32	Surgical removal
Chen S. L. et al. (2006)	Case Report	1	21	M	Probe penetration	Crystal rupture, vitral haemorrhage, choroid thickening, inferotemporal retinal tear, and retinal detachment	6/18	Vitrectomy, lensectomy, and endolaser
Seth R. K. et al. (2007)	Case Report	1	35	M	Electrical shock	Decreased visual acuity bilaterally. Right eye: IOP: 48 mmHg; angular recession; retinal dialysis; retinal haemorrhage. Left eye: anterior subcapsular opacity.	20/20	Medical treatment. Right eye: Pneumatic retinopexy and criotherapy
Han J.S. (2009)	Case Report	1	25	M	Penetration of right eyelid	Anisocoria, Vitreous Hemorrhage and globe rupture	20/40	Surgical oculoplastical
Teymororian S. et al. (2010)	Case Report	1	26	M	Probe penetration	Hemophthalmos and prolapse of the uveal tissue.	0	Enucleation
Sayegh R. R. et al. (2011)	Case Report	1	39	M	Penetration of right lower eyelid	Laceration of the eyelid, subconjunctival and retinal haemorrhage, and exudative retinal detachment after 3 days.	20/25	Surgical removal
Li J. et al. (2011)	Case Report	1	47	F	Probe penetration	Penetration and laceration of the cornea and iris, and the posterior wall of the sclera.	Light perception	Surgical removal
De Runz A. et al. (2014)	Case report	1	35	M	Penetration of left medial canthus	None	20/20	Surgical removal
Rafailov L. et al. (2015)	Case Report	1	24	M	Probe penetration	Hyphema and perforation of the sphenoid bone.	0	Enucleation
Cahill C. P. et al. (2015)	Case Report	1	36	M	Probe penetration	Hyphema and distorsion of pupil	Light perception	Surgical removal
Gapsis B. C. et al. (2015)	Case Report	1	N.R.	M	Probe penetration	Hyphema, chemosis, and periorbital edema, hyperdense vitreous and free air within the globe	0	Enucleation
Moysidid S. N. et al. (2018)	Case Series	5	24.8	5 M	2 Probe penetration, 1 penetration of zygomatic bone, 1 penetration of orbital implant, 1 penetration of upper eyelid	1 subconjuntival, disc and mild vitreous hemorrhage, 1 scleral laceration, conjuntival injiection and chemosis	1 20/20; 1 no light perception, 1 20/400, 1 20/100; 1 light perception	5 surgical removal
Kroll M. W. et al. (2018)	Case Series	20	30.3 ± 11.7	18 M, 2 F	Probe penetration	Not reported	14 complete blindness, 6 partial blindness,	12 Surgical Repair; 8 Enucleation
Thiel M. A. et al. (2020)	Letter to the Editor	1	N.R.	M	Penetration of left lower eyelid	Peripheral subretinal haemorrhage	80/100	Surgical removal
Sharabaura A.B. et al. (2021)	Case Report	1	34	M	Probe penetration	Hemorrhagic chemosis, proptosis, and prolapse of charred, coagulated uveal tissue	0	Enucleation

children, the elderly, and those who suffer from mental disorders.[28–30]

Although studies on the physiological dangers of CEWs have been conducted for about 20 years, increasing attention has recently been given to the physical concerns. In actuality, there are dangers involved with the use of CEWs, just like there are with the use of any force alternative. These dangers include those of fall-related fatalities and severe head injuries, as well as those of volatile fume igniting. In addition, the use of tasers by law enforcement can cause ocular manifestations in different ways that can range from transient symptoms such as pain and burning sensation to severe injuries such as permanent blindness.

They are primarily due to the fact that the taser acts on the central nervous system, creating an electrical wave that can cause an involuntary contraction of the muscles in the body, including those in the ocular region. This contraction can cause a series of unwanted ocular effects, including temporary loss of vision, corneal edema, rupture of blood vessels, and retinal injury.[12] Only in one case the damage was indirect and due to the electroshock that initially caused a bilateral reduction of vision, an increase in intraocular pressure, retinal hemorrhages and corneal opacity.[15] Through timely treatment, an excellent recovery of vision was observed, demonstrating that despite being fired in close proximity to the eye, but not hitting it directly, a better outcome was achieved.

However, when the taser probe penetrates the eye globe, it can cause a variety of both mechanical and electrical injuries both injuries to the ocular tissue, such as abrasions or lacerations of the cornea, injuries to the retina and the optic nerve, and electrical energy can cause vitreous and retinal hemorrhages, retinal detachments and uveal involvement generally to permanent loss of ocular function. Furthermore, the irritation and inflammation caused by the probe penetration can increase the risk of infections and further ocular damage.[12–14,16,18,20,21] In 93% of cases where the taser probe penetrated inside the eyeball, there was a severe outcome both from a surgical perspective, as 12 cases required enucleation, and from the perspective of post-correction vision, as either total or partial blindness could be observed.

Kroll et al. demonstrated that according to the globe rupture model, there is a 50% probability of a globe rupture occurring when the eye is within a distance of 6 meters from the muzzle. The likelihood of a globe rupture falls significantly beyond this distance. The critical distance for lens and retinal damage is 9 meters, which coincides with the typical range of the most frequently used probe cartridges. At distances above 9 meters, it is anticipated that there would be hyphema, as well as a hole caused by the dart component of the probe. Our forecast of globe rupture up to 6 meters (out of a usual range of 9 meters) aligns with the documented probability of enucleation or unilateral blindness, which is 69 ± 18%, along with eye penetration.[31]

Moreover, Kroll et al. hypothesized that in cases of intraocular injury in the absence of probe penetration, ocular damage could be caused by electroporation.[12] Electroporation induced by the voltage surges of CEWs has been proposed as a potential method of tissue injury. Electroporation effects appear to be limited to a distance of 1 mm from probes, where they assist sterilize the probes.[32,33] Ho et al. found that the manufacturing process makes probes that are not sterilized and have a 5% chance of being contaminated with Staphylococcus aureus.[34]

In addition, eye trauma may also be indirect caused by falls from being immobilized with a taser, with increased risk of periocular oedema and orbital wall fractures. Furthermore, frontal sinus injuries frequently occur by TASER darts.[35]

As highlighted by Ordog et al., these are more common in patients with a history of drug use, particularly PCP (phencyclidine [phenyl-cyclohexylpiperidine]), due to the violent behaviors associated with it.[11] The use of the taser in situations involving public or police control has been the subject of increasing attention in the field of medical-legal issues.[2] Moreover, as Jauchem et al. showed the effectiveness and safety of the electrical weapon have been the subject of much controversy and debate, particularly regarding the risks of serious injuries, including eye injuries, and the protocols for appropriate use.[36]

In the specific case of the eye, the fact that the Taser probe can cause permanent vision damage represents a significant factor to consider in evaluating the risk-benefit of using the device in law enforcement situations. From a medical-legal standpoint, the use of the Taser for public or police control should be based on criteria of proportionality, necessity, and effectiveness. Thus, the use of the electrical weapon should be justified only in emergency situations where the use of other control techniques is inadequate or ineffective, and should be proportionate to the threat posed by the subject involved. In fact, officers must strictly adhere to established frameworks of the law, policy, training, warnings, standards, and accountability oversight while using force. Once a threat has passed, they are not allowed to employ deadly force.[37]

Summarizing the available data, it is evident that the use of CEDs as a weapon for law enforcement may be connected to injuries, the great majority of which are deemed minor. Police acknowledge that the inclusion of probing wounds or superficial contact burns is quite likely with the usage of a CED. Compared to the amount of times these weapons have been used in all nations where they have been widely utilized for a period of years, deaths or more severe injuries recorded in the medical literature are uncommon. However, further research is still required to fully understand the fatal potential of such devices.

Indeed, it should be specified that the heightened physiological stress experienced by a person after being exposed to a CED should still be better explored, also by virtue of the fact that there is a lack of a currently recognized prehospital strategy for addressing this condition. In fact, this is also the case in the Italian context: although training has been provided in Italy for police officers who have been given access to this tool up to this point, no training has been provided for hospital staff regarding the treatment of injuries or the potential notification of injuries of a serious enough nature to endanger the life of the injured party, topic in which medical staff should receive training in order to lower the danger of failing to alert the judicial authority.[38] Having said that, it must be made clear that, in any event, using a CED shouldn't be disallowed if the risk-threat assessment turns out to be essential for situational management.

Finally, taser use protocols should be designed to minimize the risk of serious injuries, including eye injuries, and to ensure that the electrical weapon is used only by adequately trained and qualified personnel.[39]

CONCLUSION

In conclusion, the introduction of taser use for law enforcement requires serious consideration and adequate training for officers. If used responsibly, tasers could represent a less lethal alternative to other weapons used by police, but with a high potential for injuring different body organs, including the eye. It is important that there is adequate regulation to ensure individual safety and prevent abuse by law enforcement. The use of the Taser in situations involving public or police control represents a complex medical-legal challenge, which requires careful evaluation of risks and benefits and the adoption of rigorous and appropriate use protocols.

FUTURE DIRECTIONS

Research on the harm the Taser did after being employed by the police is still in its infancy and is constantly expanding. This is particularly crucial when eye injury is involved because the eyes are an organ that should be protected as much as possible, even in situations where using them to avert potentially fatal circumstances is necessary.

In fact, this document evaluates the body of literature now in existence and emphasizes the areas in which further study is needed to support its growth, particularly in the area of better training for medical professionals who will have to deal with the harm brought on by usage. This is essential given that the Italian police have already been utilizing this instrument for a year and that there may be a number of controversies around the topic. We offer both broad and detailed advice for each of these most recent topics.

Our review of the literature revealed two key factors to take into account when evaluating eye damage[1]: police officers should receive more training in handling the stressful situations in which they find themselves using it, and[2] medical staff members should receive training from emergency rooms as well as, in this case, ophthalmologists who specialize in eye emergencies.

In order to address these two issues, we propose that Italy[1]: establish, as in other nations, such as Belgium,[40] a public database accessible to all citizens on all the instances this tool is used and on all the instances check for damage following its use; and[2] offer training sessions to all healthcare professionals (doctors, nurses, etc.), with the issuance of certificates, so they can be better equipped to handle events on the front line adverse events that may occur.

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AUTHOR CONTRIBUTIONS

Conceptualization, G.A. and F.G.; methodology, M.M.C.; validation, D.L., F.C. and S.R; writing—original draft preparation, G.A. and F.G.; writing—review and editing, D.S. and G.G.; supervision, F.C. and S.R.; project administration, S.R.; funding acquisition, S.R. All authors have read and agreed to the published version of the manuscript.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author, MMC, upon reasonable request.

REFERENCES

1. Kunz SN, Zinka B, Fieseler S, Graw M, Peschel O. Functioning and effectiveness of electronic control devices such as the TASER® M- and X-series: a review of the current literature. *J Forensic Sci*. 2012;57(6):1591–1594. doi:10.1111/j.1556-4029.2012.02167.x.
2. Todak NE, Cesar GT, Louton B. Forensic reporting of TASER exposure: an examination of situational and exposure characteristics. *J Forensic Leg Med*. 2015;35:4–8. doi:10.1016/j.jflm.2015.06.010.
3. Alpert GP, Smith MR, Kaminski RJ, Fridell LA, MacDonald J, Kubu B. Police use of force, tasers and other less-lethal weapons. *NIJ Research in Brief*. 2011:1–28.
4. RCMP Use of the Conducted Energy Weapon (CEW). December 11, 2007.
5. Electrical safety: safety and health for electrical trades. 2002:12.
6. Certified lesson plan taser X26 advanced taser M26. 2003:114.
7. The conducted electrical weapon: historical overview of the technology. Atlas of conducted electrical weapon wounds and forensic analysis. 2012; 6–8.
8. Gates DF. Use of force: Taser electronic con- trol device. *Train Bulletin Of The Los Angeles Police Depart*. 1984;XVI:1–6.
9. DiVincenti FC, Moncrief JA, Pruitt BA Jr. Electrical injuries: a review of 65 cases. *J Trauma*. 1969;9(6):497–507. doi:10.1097/00005373-196906000-00004.
10. Haileyesus T, Annest JL, Mercy JA. Non-fatal conductive energy device-related injuries treated in US emergency departments, 2005–2008. *Inj Prev*. 2011;17(2):127–30. doi:10.1136/ip.2010.028704.
11. Ordog GJ, Wasserberger J, Schlater T, Balasubramanium S. Electronic gun (taser) injuries. *Ann Emerg Med*. 1987;16(1):73–78. doi:10.1016/S0196-0644(87)80292-5.
12. Kroll MW, Ritter MB, Kennedy EA, et al. Eye injuries from electrical weapon probes: incidents, prevalence, and legal implications. *J Forensic Leg Med*. 2018;55:52–57. doi:10.1016/j.jflm.2018.02.013.
13. Ng W, Chehade M. Taser penetrating ocular injury. *Am J Ophthalmol*. 2005;139(4):713–5. doi:10.1016/j.ajo.2004.11.039.
14. Chen SL, Richard CK, Murthy RC, Lauer AK. Perforating ocular injury by Taser. *Clin Exp Ophthalmol*. 2006;34(4):378–80. doi:10.1111/j.1442-9071.2006.01228.x.
15. Seth RK, Abedi G, Daccache AJ, Tsai JC. Cataract secondary to electrical shock from a Taser gun. *J Cataract Refract Surg*. 2007;33(9):1664–1665. doi:10.1016/j.jcrs.2007.04.037.
16. Teymoorian S, San Filippo AN, Poulose AK, Lyon DB. Perforating globe injury from Taser trauma. *Ophthalmic Plast Reconstr Surg*. 2010;26(4):306–8. doi:10.1097/IOP.0b013e3181c15c36.
17. Sayegh RR, Madsen KA, Adler JD, Johnson MA, Mathews MK. Diffuse retinal injury from a non-penetrating TASER dart. *Doc Ophthalmol*. 2011;123(2):135–9. doi:10.1007/s10633-011-9287-9.
18. Li JY, Hamill MB. Catastrophic globe disruption as a result of a TASER injury. *J Emerg Med*. 2013;44(1):65–67. doi:10.1016/j.jemermed.2011.03.010.
19. de Runz A, Minetti C, Brix M, Simon E. New TASER injuries: lacrimal canaliculus laceration and ethmoid bone fracture. *Int J Oral Maxillofac Surg*. 2014;43(6):722–724. doi:10.1016/j.ijom.2013.12.006.
20. Rafailov L, Temnogorod J, Tsai FF, Shinder R. Impaled orbital TASER probe injury requiring primary enucleation. *Ophthalmic Plast Reconstr Surg*. 2017;33(3S Suppl 1):S176–s7. doi:10.1097/IOP.0000000000000486.
21. Moysidis SN, Koulisis N, Rodger DC, et al. Thomas A. Swift's electric rifle injuries to the eye and ocular adnexa: the management of complex trauma. *Ophthalmol Retina*. 2019;3(3):258–69. doi:10.1016/j.oret.2018.10.005.
22. Thiel MA, Kaufmann C. Eyeshot: Ocular Injuries caused by TASER pistols. *Eur Heart J*. 2020;41(41):3984–3985. doi:10.1093/eurheartj/ehaa684.

23. Sharabura AB, Fong JW, Pemberton JD. Ocular TASER probe injury managed with primary evisceration: case report. *Case Rep Ophthalmol*. 2021;12(3):934–9. doi:10.1159/000520460.
24. Han JS, Chopra A, Carr D. Ophthalmic injuries from a TASER. *CJEM*. 2009;11(1):90–3. doi:10.1017/S1481803500010976.
25. Cahill C, Jardeleza M. Histopathology of the retina from a three year-old suspected to have Joubert syndrome. *Austin J Clini Ophthalmo*. 2015;2(4):1–17.
26. Gapsis BC, Hoang A, Nazari K, Morcos M. Ocular manifestations of TASER-induced trauma. *Trauma Case Rep*. 2017;12:4–7. doi:10.1016/j.tcr.2017.10.001.
27. Stevenson R, Drummond-Smith I. Medical implications of conducted energy devices in law enforcement. *J Forensic Leg Med*. 2020;73:101948. doi:10.1016/j.jflm.2020.101948.
28. Strote J, Walsh M, Angelidis M, Basta A, Hutson HR. Conducted electrical weapon use by law enforcement: an evaluation of safety and injury. *J Trauma*. 2010;68(5):1239–46. doi:10.1097/TA.0b013e3181b28b78.
29. Pasquier M, Carron PN, Vallotton L, Yersin B. Electronic control device exposure: a review of morbidity and mortality. *Ann Emerg Med*. 2011;58(2):178–88. doi:10.1016/j.annemergmed.2011.01.023.
30. Gardner AR, Hauda WE 2nd, Bozeman WP. Conducted electrical weapon (TASER) use against minors: a shocking analysis. *Pediatr Emerg Care*. 2012;28(9):873–877. doi:10.1097/PEC.0b013e31826763d1 .
31. Kroll MW, Ritter MB, Kennedy EA, Siegal NK, Shinder R, Brave MA, et al. Eye injury from electrical weapon probes: mechanisms and treatment. *Am J Emerg Med*. 2019;37(3):427–32. doi:10.1016/j.ajem.2018.06.004.
32. Ho J, Dawes D, Miner J, Kunz S, Nelson R, Sweeney J. Conducted electrical weapon incapacitation during a goal-directed task as a function of probe spread. *Forensic Sci Med Pathol*. 2012;8(4):358–66. doi:10.1007/s12024-012-9346-x.
33. Gowrishankar TR, Esser AT, Smith KC, Burns SK, Weaver JC. In silico estimates of cell electroporation by electrical incapacitation waveforms. Annu Int Conf IEEE Eng Med Biol Soc. 2009; 6505–6508.
34. Kroll MW, Ritter MB, Guilbault RA, Panescu D. Infection risk from conducted electrical weapon probes: what do we know? *J Forensic Sci*. 2016;61(6):1556–1562. doi:10.1111/1556-4029.13148.
35. Crawley K, Taylor R, Sandhu A. Frontal sinus injury secondary to TASER Dart: a narrative review. *J Maxillofac Oral Surg*. 2023;22(3):666–668. doi:10.1007/s12663-022-01790-7.
36. Jauchem JR. TASER® conducted electrical weapons: misconceptions in the scientific/medical and other literature. *Forensic Sci Med Pathol*. 2015;11(1):53–64. doi:10.1007/s12024-014-9640-x.
37. Rubin SN. Criminal Procedure-Search and Seizure-Law Officer's Use of Deadly Force against Nondangerous Fleeing Felon Held Violative of Fourth Amendment-Tennessee v. Garner, 471 US 1. *Seton Hall L. Rev*. 1985;17:17758.
38. Aulino G, Beccia F, Siodambro C, et al. An evaluation of Italian medical students attitudes and knowledge regarding forensic medicine. *J Forensic Leg Med*. 2023;94:102484. doi:10.1016/j.jflm.2023.102484.
39. Peel M. Assessing and managing people exposed to conducted energy device (Taser) discharge. *Emerg Nurse*. 2022;30(4):33–40. doi:10.7748/en.2022.e2126.
40. Directives relatives à l'utilisation des dispositifs à impulsion électrique par les services de police. 2019.