General Research


49. Ho JD, Minner JR, Lakireddy DR, Bultman LL, Heegaard WG. Cardiovascular and physiologic effects of conducted electrical weapon discharge in resting adults. Acad
50. Ho JD, Luceri, Richard, Lakireddy, Danunjaya R, Dawes, Donald M. Absence Of Electrocardiographic Effects Following Taser® Device Application In Human Volunteers. Hennepin County Medical Center, Minneapolis, MN; Holy Cross Hospital, Ft. Lauderdale, FL, Cleveland Clinic and Hospital, Cleveland, OH. Lompc District Hospital, Lompc, CA; 2006.

51. Ho J, Dawes D, Thacker J, Lundin E, Johnson M. Beneficial Impact of Conducted Electrical Weapons in the Mentally Ill Population. Hennepin County Medical Center, Minneapolis, MN; 2006.


75. Laur D. *Excited Delirium and its Correlation to Sudden and Unexpected Death Proximal to Restraint: A Review of the Current and Relevant Medical Literature* Victoria Police Department; April 2005.


78. Ho JD, Miner JR, Heegaard WG, Reardon RF. *Deaths in police custody: An 8 month surveillance study*: Hennepin County Medical Center; 2005.


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Title: Injury Profile of Electrical Conducted Energy Weapons
Place Published: American College of Emergency Physicians Research Forum
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Short Title: Injury Profile of Electrical Conducted Energy Weapons
Abstract: After CEW use, 99.5% of 597 subjects had no injuries or mild injuries only. The observed significant injury rate was 0.5%, and is unlikely to be greater than 1.4%. No deaths related to CEWs occurred. These preliminary data represent the largest independent injury epidemiology study of these weapons to date and support the safety of CEW use. Data collection will continue through summer 2007; final data will be presented at the fall ACEP meeting.
Abstract: There has been speculation that exposure to the discharge of a CEW may cause an increase in core body temperature, presumably from muscle-tetany induced thermogenesis (rather than a direct current effect). In many cases of sudden in-custody death, especially in cases of the excited delirium syndrome or certain legal and illegal drug toxicities, the subjects are hyperthermic. Since in many hyperthermia phenomena (e.g., heat stroke, drug-induced hyperthermic syndromes), mortality is directly related to temperature and time at that temperature, it is speculated that worsening or prolonging the hyperthermia with a CEW discharge can lead to increased mortality. The objective of this study is to determine whether a CEW discharge causes an increase in core body temperature in non-environmentally stressed resting adults. METHODS: This was a prospective, un-blinded, observational study of adult human volunteers. Subjects swallowed a telemetric temperature recording capsule and had a data recording device attached to their waists in a fanny-pack pouch. The capsule sampled core body temperature every 15 seconds. After a waiting period of at least 30 minutes for equilibration, the subjects were exposed to a 15-second continuous discharge from the TASER X26® CEW. RESULTS: A total of 21 exposure subjects were enrolled in the study. There was no change in temperature from one minute before the exposure to one minute, 10 minutes, or 20 minutes after the exposure in the majority of patients. One patient had a 0.2 degree increase at 20 minutes, three patients had a 0.1 degree decrease in temperature at 10 minutes or 20 minutes. CONCLUSIONS: In summary, our results do not show that a 15-second conducted electrical weapon discharge significantly affects core body temperature in non-environmentally stressed resting adults. While additional studies are needed, our data suggests that theories about conducted electrical weapons contributing to hyperthermia are likely unfounded.
Conducted electrical weapons (CEW) induce neuromuscular incapacitation and pain by the application of an electrical current. There has been controversy with regard to the use of these weapons and in-custody death. There has been speculation that the discharge of a CEW may induce neuroendocrine effects that might predispose subjects to delayed cardiac arrhythmias and sudden death. The objective of this study is to compare the neuroendocrine effects of the TASER X26 CEW to oleoresin capsicum (O.C.), commonly called pepper spray. METHODS: Subjects were randomized to receive either a 5-second back exposure from the TASER X26® CEW or a 2-second spray of O.C. to the eyes. Subjects had salivary samples collected by passive drool through a straw 10-15 minutes before the exposure, and at 10, 20, and 60 minutes after the exposure. Salivary samples were analyzed for quantitative measures of alpha-amylase (surrogate for sympathetic-adrenal-medulla (SAM) axis stimulation, peak at 10 minutes) and cortisol (surrogate for hypothalamic-pituitary-adrenal (HPA) axis stimulation, peak at 20 minutes). RESULTS: 10 subjects were randomized to the O.C. exposure, and 5 subjects were randomized to the CEW exposure. There was a 173% (confidence interval 37.3-308.6) increase in alpha-amylase in the O.C. group at 10 minutes compared to an 8% (-33.0-31.3) decrease in the CEW group. Non-significant results included: 1) at one hour, alpha-amylase was 44% (11.8-75.6) over baseline in the O.C. group and 9% (-31.5-49.8) over baseline in the CEW group, 2) there was a 89% (41.9-135.3) increase in cortisol in the O.C. group at 20 minutes and a 90% (-61.3-242.0) increase in the CEW group, 3) at one hour, cortisol was 15% (-44.7-75.2) over baseline in the O.C. group and 68% (-114.4-242.0) over baseline in the CEW group. CONCLUSIONS: The results suggest a significant greater level of activation of the SAM cascade with O.C. compared to the CEW. Overlapping confidence intervals preclude a definitive statement about the other measurements, but do not suggest a greater activation of the stress cascade by the CEW than O.C.
The TASER X26 conducted electrical weapon (CEW) has a maximum range of 35 feet. TASER International has developed a new non-tethered CEW that is fired from a 12-gauge shotgun that has a longer range. A previous study showed that the TASER X26 had no significant effect on respiratory parameters. Here we examine the effects of this new CEW on respiration, venous blood gases, and certain blood chemistries.

METHODS: Subjects had venipuncture prior to and immediately after the CEW exposure, and venous samples were analyzed to obtain venous pH, pCO2, HCO3, lactate, Na, and K. Breathing data was collected by a breath by breath gas-exchange system. All subjects were exposed for a minimum of 15 seconds. Exposure was thoraco-abdominal. In 27 subjects, the device was programmed for a 45-second exposure. The subjects could terminate the exposure after 15 seconds. In 23 subjects, the exposure was fixed at 20 seconds. In 4 of these subjects, the device was programmed to deliver 2 exposures. The first exposure was the standard thoraco-abdominal exposure, and the second was between the contra-lateral abdomen and the thigh. RESULTS: Fifty (50) subjects completed the study. In the self-terminating group, respiratory rate and minute ventilation increased significantly during the exposure. End-tidal CO2 decreased significantly during exposure. Venous pH decreased by 0.023, pO2 increased by 13.4, HCO3 decreased by 2.8, lactate increased by 2.4, and potassium decreased by 0.13. In the fixed 20-second exposure group, respiratory rate and minute ventilation increased significantly during the exposure. End-tidal CO2 decreased and end-tidal O2 increased significantly during exposure. Venous pH did not significantly change. pCO2 decreased by 4.0, pO2 increased by 16.3, HCO3 decreased by 3.4, and lactate increased by 2.7. Chemistries had no significant change. CONCLUSIONS: This study demonstrates that the new CEW has no important deleterious effects on respiratory parameters, blood chemistries, or venous blood gases. These results are consistent with previous results for the TASER X26 CEW.
Introduction: Conducted electrical weapon (CEW) use by law enforcement is growing. There are societal concerns about the safety of CEWs and their possible role in causing death related to worsening metabolic acidosis. Previous CEW work indicates a high degree of safety but has only been done on rested subjects for brief exposure periods which may not simulate reality. It is thought that CEW field use is often prolonged and applied to acidic subjects. We examine the physiologic effect of prolonged CEW use on acidic humans.

Methods: Human subjects underwent monitoring after an anaerobic exercise regimen followed by a 15 second CEW application. Venous blood was collected before and after exercise to verify acidosis and again after CEW exposure to evaluate effect. A control sample that exercised but underwent sham CEW exposure was also included for comparison. Samples were analyzed for markers of cardiac muscle injury and acidosis. Data were analyzed using descriptive statistics.

Results: A total of 44 subjects were enrolled (43 males, 1 female) with a mean age of 39.2 years (+ 6.8, range 29 to 53). There were 6 control and 38 CEW exposures. There was a similar decrease in pH after exercise in both the controls (17.4%, 95% CI = 0.7 to 34.1) and the exposed subjects 14.9%, 95% CI = 12.5 to 17.5). Following both sham and real CEW exposure, a similar increase in pCO2 (28.9%, 95% CI = 7.5 to 50.2 in controls vs. 13.5%, 95% CI = 6.0 to 20.9 in exposed), a similar increase in PO2 (44.9%, 95% CI = 18.8 to 30.9 in controls vs. 21.8%, 95% CI = 7.0 to 36.7 in exposed) and similar increases in serum lactate (7.7, 95% CI = 0.9 to 16.2 in controls vs. 7.5, 95% CI = 6.5 to 8.6 in exposed) were found. All troponin I levels were <0.3 ng/mL.

Conclusions: Markers of acidosis and cardiac injury were similar among acidic subjects who underwent both sham and real prolonged CEW exposure. Prolonged CEW exposure in humans does not appear to have an effect with regard to worsening acidosis that is already present.
Abstract: Background: Conducted electrical weapons (CEWs) are used by police for control of subjects by causing pain and neuromuscular incapacitation. There has been scrutiny of CEWs and their potential role in the sudden death of subjects in custody. While there are numerous cases every year of custodial deaths when no CEW is used, criticism of this device has led to a hypothesized causal relationship. One theory is that CEWs may cause death from cardiac dysrhythmia. Previous work has shown that CEW application for 5 seconds does not induce dysrhythmias in resting humans. We sought to determine if prolonged exposure to a CEW in an exerted human sample population caused detectable change in the 12-lead electrocardiogram (ECG).

Methods: 25 human volunteers were studied after receiving institutional review board approval. All subjects had a baseline ECG obtained and were then put through a regimen of timed push-ups and a sprint on a treadmill at 8.5 degrees of elevation until subjective exhaustion. This was to simulate the physical exertion often seen in subjects prior to CEW application in the field by police. The volunteers then received a continuous 15-second application from a TASER X26 CEW (TASER Intl., Scottsdale, AZ). Volunteers received random positions of the CEW electrodes on their thoraces, either both electrodes in front or both in back. Electrode positions involved at least a 12 inch spread and always encompassed the normal anatomic position of the heart. An ECG was obtained following CEW exposure. All ECGs were interpreted by a blinded cardiologist.

Results: At baseline, 24/25 ECGs were normal. One baseline ECG was abnormal due to several monomorphic premature ventricular complexes. After CEW exposure, all 25 ECGs were interpreted as normal.

Conclusions: Prolonged 15 second CEW application in a physically exhausted adult human sample did not cause a detectable change in their 12-lead ECGs. Theories of
CEW induced dysrhythmias are not supported by our findings.

Reference Type: Poster
Abstract: Deaths in police custody can evoke strong reactions from the victims' families, the lay press, and the public. Police departments may be forced to prove that their actions (or inactions) did not contribute to these deaths. It is imperative for police chiefs and their staffs to have a good understanding of the history of this phenomenon, to understand the theories of causation in these sudden deaths, and to have a basic understanding of the current medical literature. In this workshop, these topics will be reviewed with a particular emphasis on conducted electrical weapons (CEW). The complex phenomenon of excited delirium will be reviewed as a theory of causation.
Physiological Effects of a Conducted Electrical Weapon on Human Subjects

STUDY OBJECTIVE: Sudden death after a conducted electrical weapon exposure has not been well studied. We examine the effects of a single Taser exposure on markers of physiologic stress in healthy humans.

METHODS: This is a prospective trial investigating the effects of a single Taser exposure. As part of their police training, 32 healthy law enforcement officers received a 5-second Taser electrical discharge. Measures before and for 60 minutes after an exposure included minute ventilation; tidal volume; respiratory rate (RR); end-tidal CO$_2$; oxygen saturation, pulse rate; blood pressure (systolic blood pressure/diastolic blood pressure); arterialized blood for pH, PO$_2$, PCO$_2$, and lactate; and venous blood for bicarbonate and electrolytes. Troponin I was measured at 6 hours. Data were analyzed using a repeated-measures ANOVA and paired t tests.

RESULTS: At 1 minute postexposure, minute ventilation increased from a mean of 16 to 29 L/minute, tidal volume increased from 0.9 to 1.4 L, and RR increased from 19 to 23 breaths/min, all returning to baseline at 10 min. Pulse rate of 102 beats/min and systolic blood pressure of 139 mm Hg were higher before Taser exposure than at anytime afterward. Blood lactate increased from 1.4 mmol/L at baseline to 2.8 mmol/L at 1 minute, returning to baseline at 30 minutes. pH and bicarbonate decreased, respectively, by 0.03 and 1.2 mEq/L at 1 minute, returning to baseline at 30 minutes. All troponin I values were normal and there were no EKG changes. Ventilation was not interrupted, and there was no hypoxemia or hypercarbia.

CONCLUSION: A 5-second exposure of a Taser X-26 to healthy law enforcement personnel does not result in clinically significant changes of physiologic stress.
AIMS: High voltage electric current can adversely affect pacemakers (PM) and implantable cardioverter-defibrillator (ICD). The standard shock from an electrical stun gun (TASER-X26(R)), TASER International, Scottsdale, AZ) consists of a 5-s long application of high voltage, low current pulses at 19 pulses per second. Its effect on the functional integrity of PM and ICDs is unknown. METHODS AND RESULTS: We tested the functional integrity of nine PMs and seven ICDs in a swine model after a standard stun gun shock. A transvenous, dual coil, bi-polar ICD lead (St Jude-SP01) and a PM lead were placed in the right ventricular (RV) apex and connected to pulse generators buried in the pre-pectoral pocket. The two darts were placed at the sternal notch (SN) and apex of the heart bracketing the device pocket. Standard neuromuscular incapacitating (NMI) discharges were delivered. Functional parameters of the devices and leads were checked before and after the shocks. The mean pacing thresholds, sensing thresholds, pacing impedances, and defibrillation coil impedances of the ICD lead were similar before and after the shocks. Similarly, pacing thresholds, sensing thresholds, and impedances of the PM lead were not significantly different before and after the shocks. No significant change was noted in battery voltage and projected longevity. Implantable cardioverter-defibrillator generators detected the NMI impulses at a mean cycle length of 176 +/- 20 ms with detection to charge time of 5.9 +/- 1.5 s. Shock delivery was aborted in all tests as tachycardia detection abruptly terminated at the end of the 5 s NMI application. None of the devices exhibited power on reset (POR), elective replacement indicator (ERI), or noise mode behaviour after the shock. CONCLUSION: Pacemakers and ICD generators and leads functions were not affected by the tested standard 5 s stun gun shocks.

Notes: Journal article


Language: Eng
In a previous study, 18 repeated exposures of anaesthetized swine to an electro-muscular incapacitating device (TASER International's ADVANCED TASER(R) X26 electronic control device) resulted in acidosis and increases in blood electrolytes. In the current study, experiments were performed to investigate effects of a more typical scenario of repeated exposures of the device on muscle contraction and changes in blood factors. Ten swine were exposed for 5s, followed by a 5-s period of no exposure, three times. Selected blood factors were monitored for 3h following exposure. Transient increases in blood glucose, lactate, sodium, potassium, calcium, and pCO(2) were consistent with previous reports in the literature dealing with studies of muscle stimulation or exercise. Blood pH was decreased immediately following exposure, but subsequently returned toward a normal level. Oxygen saturation (measured by pulse oximetry) was not changed significantly. In conclusion, three repeated TASER device exposures had only transient effects on blood factors, which all returned to pre-exposure levels, with the exception of hematocrit (which remained elevated after 3h). Since the increase in this factor was less than that which may occur after short periods of exercise, it is unlikely that this would be an indicator of any serious harm.

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Abstract: Objectives: EMS providers are often the first to medically manage persons subjected to a Taser activation. As the Taser uses high-voltage electricity to incapacitate subjects, we sought to evaluate cardiac rhythm changes during a Taser activation.

Methods: This prospective study was performed on 32 healthy volunteer subjects receiving a shock from the Taser X-26. The subjects had a baseline 12 lead ECG performed immediately before and within 1 minute post Taser activation. One minute post Taser activation was considered clinically relevant as most reported deaths following Taser use occur after 1 min, and thus any electrocardiac changes, such as QT prolongation, should be captured if present. Primary endpoints included evaluation of changes in cardiac rhythm, morphology, and interval duration. Descriptive statistics and paired Student’s t-test comparisons are reported (p < 0.05) (SPSS).

Results: In all 32 subjects an interpretable 12 lead ECG was obtained prior to and after the Taser activation, except for one post-Taser ECG (PR interval indeterminant). The average age was 33 and BMI 26.5 kg/m2. Overall, there was a significant increase in mean heart rate (2.4; 95% CI = 0.0 to 4.9; p < 0.05) and decrease PR interval (26.5; 95% CI = 29.7 to 23.3; p < 0.001). When stratified by gender, the only significant change was a decrease in PR interval in men (p < 0.01). When stratified by BMI, a significant increase in heart rate and decreases in PR and QT intervals are noted (4.0; 95% CI = 1.3 to 6.7 for HR, 26.0; 95% CI = 211.3 to 20.7 for PR interval and -18.8; 95% CI = 233.2 to 24.3 for QT Interval) among normals. In all cases, none of the subjects had a QTc pre- or post Taser activation that exceeded 0.44 seconds. None of the statistically significant differences between ECG measures were clinically relevant.

Conclusions: There were no cardiac dysrhythmia, interval or morphology changes in human subjects who received a Taser shock on evaluation of a 12 lead
ECG performed immediately before and after Taser activation.

258 TASER Discharges Capture Cardiac Rhythm in a Swine Model


Stroger Hospital of Cook County

Objectives: Data from our group and from others suggest that the TASER X26 can seriously alter cardiac function in experimental animals. We hypothesized that TASER X26 discharges can greatly reduce cardiac performance.

Methods: Using an IACUC approved protocol, 13 standard pigs (22-77 kg; 6 experimentals, 5 sham and 2 paralyzed sham controls) were anesthetized with ketamine and xylazine. Experimentals were paralyzed with succinylcholine (2 mg/kg) then exposed to two 40 sec discharges from a TASER X26 (TASER Intl., Scottsdale, AZ) across the torso. Blood pressure, vital signs, troponin I, blood gases, and electrolyte levels were obtained preexposure and at 5, 15, 30 and 60 min and 24, 48 and 72 hrs post-discharge. EKGs and echocardiography were performed before, during, and after the discharges using a GE Logiq7 ultrasound. P-values <0.05 were considered significant.

Results: The EKG was unreadable during the discharges due to electrical interference, but echo images were not affected. During the discharges, cardiac rhythm was captured immediately at a rate of approximately 300 beats/min in all animals. This capture continued for the duration of the discharge and, in 3 cases, sinus rhythm was regained within 5 sec of discontinuing the discharge. In 2 other animals, ventricular fibrillation (VF) was seen after the discharge by echo and EKG. In 1 animal, spontaneous reversion to sinus rhythm occurred after 15 sec, and in the other VF resulted in death. Another animal showed ventricular tachycardia for <5 sec before reverting to sinus rhythm. In these 3 cases, the rhythm as seen during discharge by echo did not change when the discharge stopped. Blood chemistry values were not significantly affected in the post-discharge period. In surviving animals, heart rate was not significantly affected and hypotension was absent.

Conclusions: Given the possibility of cardiac capture with TASER discharges, cardiac monitoring should be performed on exposed subjects.
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Results: The EKG was unreadable during the discharges due to electrical interference, but echo images were not affected. During the discharges, cardiac rhythm was captured immediately at a rate of approximately 300 beats/min in all animals. This capture continued for the duration of the discharge and, in 3 cases, sinus rhythm was regained within 5 sec of discontinuing the discharge. In 2 other animals, ventricular fibrillation (VF) was seen after the discharge by echo and EKG. In 1 animal, spontaneous reversion to sinus rhythm occurred after 15 sec, and in the other VF resulted in death. Another animal showed ventricular tachycardia for <5 sec before reverting to sinus rhythm. In these 3 cases, the rhythm as seen during discharge by echo did not change when the discharge stopped. Blood chemistry values were not significantly affected in the post-discharge period. In surviving animals, heart rate was not significantly affected and hypotension
was absent.

Conclusions: Given the possibility of cardiac capture with TASER discharges, cardiac monitoring should be performed on exposed subjects.

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**Author:** Vilke, Gary; Sloane, Christian; Bouton, Katie; Levine, Saul; Neuman, Tom; Castillo, Edward; Kolkhorst, Fred; Chan, Theodore

**Year:** 2007

**Title:** Cardiovascular and Metabolic Effects of the Taser on Human Subjects

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**Abstract:**

**Objectives:** The Taser X26 is reported to be used by over 30% of police agencies in the United States. The purpose of this study was to examine the effects of a single Taser exposure on cardiovascular (CV) and blood parameters in human subjects.

**Methods:** Prospective study on human volunteers receiving a 5 second Taser activation. Baseline CV measurements and blood samples were taken prior to Taser exposure and for 60 min afterwards. CV measurements included systolic (SBP) and diastolic (dBP) blood pressures, and heart rate. Blood measures included venous calcium, sodium, and potassium levels, and arterialized capillary samples for pH, bicarbonate and lactate. Data were analyzed using repeated measures ANOVA (alpha = 0.05) with 95%CI.

**Results:** Data were collected on 32 men and women law enforcement officers (38.4 _ 7.7 yr; 196.8 _ 33.1 lbs). Measures for SBP, bicarbonate, lactate and pH were different overall (p<0.05). SBP decreased linearly from a slight state of anxiety prior to Taser (139.7 mmHg at baseline) to normal (123.2 mmHg at 60 minutes) (decrease = 16.5, CI = 12.7 to 20.3). There were no differences in any other measure (p > 0.05). Differences in blood measurements from baseline are in the table above.

**Conclusions:** There were no clinically significant or lasting statistically significant changes in cardiovascular, electrolyte, lactate or pH levels in human subjects after a 5 second Taser activation.
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Objectives: The Taser is a weapon that delivers high-voltage, low amperage electricity in a pulsed waveform and is representative of the group of less lethal weapons known as “CED’s” (conducted energy devices). Although generally regarded as safe, little research exists in the literature despite reported sudden deaths associated with CED use. Through prior study we noted no change in cardiac rhythm of human subjects during a brief Taser X-26 activation. In the present study, the authors hypothesized that the Taser X-26 discharge would not result in direct myocardial injury as measured by a rise in the troponin I cardiac enzyme after deployment of the device on healthy volunteers.

Methods: This prospective cohort study was performed with law enforcement personnel receiving training on the Taser X-26. The voluntary subjects had a single serum troponin I measured 6 hours after each received a Taser X-26 discharge as part of their training. The primary endpoint was development of a positive troponin I (> 0.2 ng/ml). Descriptive statistics were used, calculated using a computerized statistics program (STATA).

Results: A total of 66 subjects volunteered and underwent a Taser X-26 shock delivery. The mean duration of discharge received was 4.36 seconds, range 1.2-5 seconds. All subjects had a blood draw 6 hours after receiving the shock. Troponin I values for all subjects were <0.2 ng/ml, with a positive assay defined as >0.2 ng/ml. (95% CI = 0 to 0.054).

Conclusions: Though limited by short shock duration, human volunteers exposed to a single shock from the Taser did not develop an abnormal serum troponin I level 6 hours after shock, suggesting that there was no myocardial necrosis.
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Date: June 10-15, 2007
Short Title: Numerical Estimation of TASER CEW Current Flow and Effects on Human Body
Abstract: Introduction: Conducted electrical weapons (CEW) use by law enforcement has raised concerns about their safety and possible role with in-custody deaths. Previous CEW work indicates a high degree of safety but has only been done on non-intoxicated subjects for brief exposure periods. It has been postulated that CEW field use may be more prolonged and have different physiologic effects on intoxicated subjects. We examined the physiologic effect of prolonged CEW use on intoxicated subjects.

Methods: After obtaining baseline blood samples, subjects were given mixed drinks in a controlled setting to achieve a blood alcohol level of 0.08 mg/dl. Blood was again drawn after reaching the target alcohol level. Subjects were then exposed to a 15 sec CEW discharge. Blood was drawn immediately afterward and again at 24 hrs. Samples were analyzed for markers of acidosis and troponin. Data were compared using T-tests.

Results: 26 subjects were enrolled, 22 with CEW exposures and 4 as controls. There was no difference between groups for baseline pH, pCO2, lactate or troponin. Following intoxication but prior to CEW exposure, there was no difference between groups in EtOH (0.12 vs. 0.11, p > 0.7) or repeat measures of pH, pCO2 and lactate. Following CEW exposure, study group values were compared to their own intoxicated pre-exposure values. There was a small drop in pH (pre 7.37 vs. post 7.32, p < 0.005), a rise in pCO2 that did not reach significance (pre 43.4 vs. post 48.5, p > 0.06), and a rise in lactate (pre 2.0 vs. post 4.2, p < 0.0001). At 24-hour post exposure, there was again no difference between controls and study group in pH, lactate and troponin. There was a small statistically significant change in pCO2 (42.4 vs. 46.3, p < .02). All troponins were in the normal range.

Conclusions: Intoxicated adults with prolonged CEW exposure...
demonstrate small transient increases in measures of acidosis and no change in markers of cardiac injury. The increased acidosis was not clinically significant and self corrected.
Reference Type: Presentation
Author: Lakkireddy, Dhanunjaya R.; Wallick, Donald; Antenacci, Jennifer A.; Kowalewski, William; Martin, David; Chung, Mina; Wazni, Oussama; Patel, Dimpi; Natale, Andrea; Tchou, Patrick
Year: 2007
Title: Do Electrical Stun Guns (TASER-X26®) Affect the Functional Integrity of Implantable Pacemakers and Defibrillators?
Place Published: Heart Rhythm Society Conference Denver, CO
Date: May 12
Short Title: Do Electrical Stun Guns (TASER-X26®) Affect the Functional Integrity of Implantable Pacemakers and Defibrillators?
Reference Type: Presentation
Author: Lakkireddy, Dhanunjaya R; Vacek, James; Wallick, Donald; Kowalewski, William; Martin, David; Butany, Jagdish; Natale, Andrea; Tchou, Patrick
Year: 2007
Title: Effect of Varying Dart Separation along the Cardiac Axis on Ventricular Arrhythmia Induction during TASER Application
Place Published: Heart Rhythm Society Conference Denver, CO
Publisher: Heart Rhythm Society
Date: May 9
Short Title: Effect of Varying Dart Separation along the Cardiac Axis on Ventricular Arrhythmia Induction during TASER Application
Abstract: Sudden, in-custody death (SICD) events are alarming phenomena that occur numerous times per year in this country. With increasing usage of electronic control devices (ECD), such as TASER® brand devices by law enforcement, the number of SICD events that are temporally related to ECD applications is growing. The autopsy in such a case presents a diagnostic challenge to the medical examiner as there are no postmortem tests available to detect past electrical applications. We believe that because ECD technology is relatively new, medical examiners may not be fully aware of what these devices are and are not capable of and may, therefore, be making errors in diagnostic judgment. We analyzed the probable error rate in assigned causes of death based on a convenience sample population.
Background: Conducted electrical weapons (CEWs) are used by law enforcement to subdue combative subjects. Occasionally, subjects will die after a CEW has been used on them. It is theorized that CEWs may contribute to these deaths by impairing respiration. Objectives: To examine the respiratory effects of CEWs. Methods: Human volunteers received a 15-second application of electrical current from a CEW while wearing a respiratory measurement device. Common respiratory parameters were collected before, during, and after exposure. Health histories and demographic information were also collected. Results: Fifty-two subjects were analyzed. Thirty-four underwent a 15-second continuous exposure, and 18 underwent three 5-second burst exposures. In the continuous application group, the baseline mean tidal volume of 1.1 L increased to 1.8 L during application, the baseline end-tidal CO2 level went from 40.5 mm Hg to 37.3 mm Hg after exposure, the baseline end-tidal oxygen level went from 118.7 mm Hg to 121.3 mm Hg after exposure, and the baseline respiratory rate went from 15.9 breaths/min to 16.4 breaths/min after exposure. In the 5-second burst group, the baseline mean tidal volume increased to 1.85 L during application, the baseline end-tidal CO2 level went from 40.9 mm Hg to 39.1 mm Hg after exposure, the baseline end-tidal oxygen level went from 123.1 mm Hg to 127.0 mm Hg after exposure, and the baseline respiratory rate went from 13.8 breaths/min to 14.6 breaths/min after exposure. Conclusions: Prolonged CEW application did not impair respiratory parameters in this population of volunteers. Further study is recommended to validate these findings in other populations.
Abstract: There appears to be increasing interest in ECD use in society from law enforcement, military and personal defense perspectives. Along with increasing use of these devices, there is also a heightened awareness of perceived association with SD events. This perception may be stimulated by media inaccuracy and sensationalism at times. It may also be the product of misapplied logic. There have been numerous human studies investigating the possible association between ECD application and SD events. To date, no clear association has been demonstrated when examining the currently recognized etiologies of sudden death such as cardiogenic, pulmonary, metabolic or thermoregulatory causes. Additionally, data exists to show that ECD use has the potential to save human lives within certain populations. We believe that further study of ECDs is recommended to validate our findings.
Absence of Electrocardiographic Change Following Prolonged Application of a Conducted Electrical Weapon in Physically Exhausted Adults

Author: Ho, Jeffrey; Dawes, Donald; Calkins, Hugh; Johnson, Mark
Year: 2007
Title: Absence of Electrocardiographic Change Following Prolonged Application of a Conducted Electrical Weapon in Physically Exhausted Adults
Place Published: Hennepin County Medical Center

Abstract: Background: Conducted electrical weapons (CEWs) are used by police for control of subjects by causing pain and neuromuscular incapacitation. There has been scrutiny of CEWs and their potential role in the sudden death of subjects in custody. While there are numerous cases every year of custodial deaths when no CEW is used, criticism of this device has led to a hypothesized causal relationship. One theory is that CEWs may cause death from cardiac dysrhythmia. Previous work has shown that CEW application for 5 seconds does not induce dysrhythmias in resting humans. We sought to determine if prolonged exposure to a CEW in an exerted human sample population caused detectable change in the 12-lead electrocardiogram (ECG).

Methods: 25 human volunteers were studied after receiving institutional review board approval. All subjects had a baseline ECG obtained and were then put through a regimen of timed push-ups and a sprint on a treadmill at 8.5 degrees of elevation until subjective exhaustion. This was to simulate the physical exertion often seen in subjects prior to CEW application in the field by police. The volunteers then received a continuous 15-second application from a TASER X26 CEW (TASER Intl., Scottsdale, AZ). Volunteers received random positions of the CEW electrodes on their thoraces, either both electrodes in front or both in back. Electrode positions involved at least a 12 inch spread and always encompassed the normal anatomic position of the heart. An ECG was obtained following CEW exposure. All ECGs were interpreted by a blinded cardiologist.

Results: At baseline, 24/25 ECGs were normal. One baseline ECG was abnormal due to several monomorphic premature ventricular complexes. After CEW exposure, all 25 ECGs were interpreted as normal.

Conclusions: Prolonged 15 second CEW application in a physically exhausted adult human sample did not cause a detectable change in their 12-lead ECGs. Theories of CEW induced dysrhythmias are not supported by ou
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Conclusions: Prolonged 15 second CEW application in the field caused no detectable change in the 12-lead ECG.
a physically exhausted adult human sample did not cause a detectable change in their 12-lead ECGs. Theories of CEW induced dysrhythmias are not supported by our findings.

**URL**: http://www.aemj.org/cgi/content/full/14/5_Supplement_1/S128-b?ct=ct
Abstract: Introduction: Conducted electrical weapon (CEW) use by law enforcement is growing. There are societal concerns about the safety of CEWs and their possible role in causing death related to worsening metabolic acidosis. Previous CEW work indicates a high degree of safety but has only been done on rested subjects for brief exposure periods which may not simulate reality. It is thought that CEW field use is often prolonged and applied to acidotic subjects. We examine the physiologic effect of prolonged CEW use on acidotic humans.

Methods: Human subjects underwent monitoring after an anaerobic exercise regimen followed by a 15 second CEW application. Venous blood was collected before and after exercise to verify acidosis and again after CEW exposure to evaluate effect. A control sample that exercised but underwent sham CEW exposure was also included for comparison. Samples were analyzed for markers of cardiac muscle injury and acidosis. Data were analyzed using descriptive statistics.

Results: A total of 44 subjects were enrolled (43 males, 1 female) with a mean age of 39.2 years (+ 6.8, range 29 to 53). There were 6 control and 38 CEW exposures. There was a similar decrease in pH after exercise in both the controls (17.4%, 95% CI = 0.7 to 34.1) and the exposed subjects 14.9%, 95% CI = 12.5 to 17.5). Following both sham and real CEW exposure, a similar increase in pCO2 (28.9%, 95% CI = 7.5 to 50.2 in controls vs. 13.5%, 95% CI = 6.0 to 20.9 in exposed), a similar increase in PO2 (44.9%, 95% CI = 18.8 to 30.9 in controls vs. 21.8%, 95% CI = 7.0 to 36.7 in exposed) and similar increases in serum lactate (7.7, 95% CI = 0.9 to 16.2 in controls vs. 7.5, 95% CI = 6.5 to 8.6 in exposed) were found. All troponin I levels were <0.3 ng/mL.

Conclusions: Markers of acidosis and cardiac injury were similar among acidotic subjects who underwent both sham and real prolonged CEW exposure. Prolonged
CEW exposure in humans does not appear to have an

Reference Type: Journal Article

Author: Ho, Jeffrey; Dawes, Donald; Bultman, Laura; Moscati, Ronald; Skinner, Lisa; Bahr, Jennifer; Reardon, Robert; Johnson, Mark; Miner, James

Year: 2007

Title: Physiologic Effects of Prolonged Conducted Electrical Weapon Discharge on Acidotic Adults

Journal: Acad Emerg Med

Volume: 14

Issue: 5

Pages: 63

Short Title: Physiologic Effects of Prolonged Conducted Electrical Weapon Discharge on Acidotic Adults

Abstract: Introduction: Conducted electrical weapon (CEW) use by law enforcement is growing. There are societal concerns about the safety of CEWs and their possible role in causing death related to worsening metabolic acidosis. Previous CEW work indicates a high degree of safety but has only been done on rested subjects for brief exposure periods which may not simulate reality. It is thought that CEW field use is often prolonged and applied to acidotic subjects. We examine the physiologic effect of prolonged CEW use on acidotic humans.

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Conclusions: Markers of acidosis and cardiac injury were similar among acidotic subjects who underwent both sham and real prolonged CEW exposure. Prolonged CEW exposure in humans does not appear to have an effect with regard to worsening acidosis that is already present.

URL: http://www.aemj.org/cgi/content/full/14/5_Supplement_1/S63-a?ct=ct
Abstract: The Taser has gained widespread popularity with law enforcement as a less lethal weapon to subdue combative individuals. Because sudden deaths have been associated with their use, concern has arisen regarding the physiologic effects of these devices, including respiratory function.

Objectives: We sought to determine the effect of the Taser on respiratory physiology, and hypothesized that the Taser would not cause significant decrement in pulmonary function, oxygenation or ventilation in human subjects.

Methods: We conducted a randomized crossover, controlled trial in 28 human volunteers who underwent a standard 5 second Taser X26 discharge as part of law enforcement training. Subjects were monitored for tidal volume (TV), respiratory rate (RR), minute ventilation (VE), end-tidal CO2 (etCO2), and transcutaneous oximeter (SaO2) at baseline, during and 1, 10, 30 and 60 minutes after Taser discharge. Arterialized capillary samples for pH, pO2, and pCO2 were obtained at baseline, 1, 10, 30 and 60 minutes. Data were compared utilizing repeated measures ANOVA (p < 0.05) with differences and 95% confidence intervals [CI] reported (SPSS). Clinical significance was defined a priori as evidence of hypoxemia (SaO2 < 95%, pO2 < 85 mmHg) or hypoventilation (etCO2 or pCO2 > 45 mmHg).

Results: Mean VE, TV, and RR all increased at 1 min. after Taser discharge (increases of 12.8 L/m [8.5, 17.1], 0.5 L/breath [0.3, 0.7], and 3.8 breaths/min [1.6, 5.9], respectively), and returned to baseline levels at 10, 30 and 60 min. Mean pH decreased at 1 min. (20.02 [20.04, 0.01]), and returned to baseline levels at 10, 30 and 60 min. There were no differences in SaO2, pO2, etCO2, or pCO2 over time and no evidence of abnormal hypoxemia or hypoventilation.

Conclusions: In our study on human volunteers, VE, TV,
and RR increased immediately following a standard Taser discharge, but returned to baseline within 10 minutes. There was no evidence of hypoxemia or hypoventilation in our study subjects.
Abstract: Introduction: The Taser has gained widespread popularity with law enforcement as a less lethal weapon to subdue combative individuals. Because sudden deaths have been associated with their use, concern has arisen regarding the physiologic effects of these devices, including respiratory function.

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and RR increased immediately following a standard Taser discharge, but returned to baseline within 10 minutes. There was no evidence of hypoxemia or hypoventilation in our study subjects.

URL: http://www.aemj.org/cgi/reprint/14/5_Supplement_1/S191-b
Abstract: This supplement is intended to complement the two PSDB reports on evaluations of taser devices published in 2002 and 2005. It is a collection of source material, commissioned during the evaluations, which has not been previously published. It contains seven full reports from the Defence Science and Technology Laboratory, which informed the DOMILL1 statements on the medical implications of taser use, the Association of Chief Police Officers report on the operational trial and a report on taser compatibility with commercial aircraft systems.

Reference Type: Poster
Author: Will J, Wu Jiu-Yan, O'Rourke A, Huebner S, Webster G
Year: 2006
Title: CAN TASERS® DIRECTLY CAUSE VENTRICULAR FIBRILLATION?
Place Published: University of Wisconsin-Madison
Short Title: CAN TASERS® DIRECTLY CAUSE VENTRICULAR FIBRILLATION?
Reference Type: Report
Author: Webster, J.G.
Year: 2006
Title: Electromuscular Incapacitating Devices
City: Madison, WI
Institution: University of Wisconsin-Madison
Short Title: Electromuscular Incapacitating Devices
Can Tasers® directly cause ventricular fibrillation?

Tasers are battery powered electrical devices used by law enforcement personnel to temporarily incapacitate a suspect. This study is a portion of a larger study to determine the probability of a Taser (X26 and M26) causing ventricular fibrillation (VF) in humans. We determined the distance between a Taser dart and the ventricle (dart-to-heart distance) necessary to trigger VF in an in-vivo porcine model, using 10 anesthetized pigs. All experiments were approved by the appropriate IUCUC and adhere to all applicable laws and standards of the NIH and USDA as well as the policies of the APS.

To more accurately represent the dart-to-heart distances found in a human, we reflected the skin, subcutaneous fat and muscle over the sternum and placed a thoracic dart into the third intercostal space over the right ventricle. Current flowed to a second dart 15 to 54 cm away on the abdomen. We determined that the distance between the darts makes no significant difference in the current. We directly measured the dart-to-heart distance and confirmed it post mortem. The dart-to-heart distance that causes VF is 17 mm ± 6.48 (SD) for the first VF event and 13.7 mm ± 6.79 (SD) for the average of the successive VF events. We will combine these data with echocardiographic human anatomic data, police-provided dart landing distribution data, and a finite element method (FEM) model of current density in the human torso to yield a probability of a Taser causing VF in a human.
Reference Type: Conference Paper
Author: Sun, Hongyu; Abdallah, Jiun-Yan Wu Rami; Webster, John G.
Year: 2006
Title: Electromuscular Incapacitating Device Safety
Conference Location: Madison, WI
Publisher: University of Wisconsin-Madison/Department of Electrical and Computer Engineering
Link to PDF: internal-pdf://Hongyu Sun, Jiun-Yan Wu, Rami Abdallah, and John G. Webster.pdf
Abstract: OBJECTIVE: The Taser is an electric weapon capable of releasing significant amounts of electricity in rapid pulses, causing uncontrollable muscle contraction. Use of this weapon has dramatically increased over the past decade, and it is now commonly used by law enforcement officers nationwide. Emergency medical services providers are, likewise, seeing more patients who have recently been subjected to application of a Taser. We examined the autopsy reports of patients who died after application of a Taser in an attempt to identify high-risk interactions. METHODS: This is a case series of Taser-related deaths. Fatalities occurring over four years beginning in January 2001 were identified through an Internet search, and autopsy reports were requested. Reports were analyzed for patient demographics, preexisting cardiac disease, toxicology, evidence of excited delirium, restraint techniques used, and listed cause of death. RESULTS: Of 75 cases identified, 37 (49.3%) had autopsy reports available for review. All cases involved men, with ages ranging from 18 to 50 years. Cardiovascular disease was found in 54.1%. Illegal substance use was found on toxicology screening for 78.4%; within that group, 86.2% were found to have been using stimulants. A diagnosis of excited delirium was given for 75.7% of the cases. Use of a Taser was considered a potential or contributory cause of death in 27%. CONCLUSIONS: This is the largest review of Taser-related fatalities reported in the medical literature. The findings are consistent with prior studies, suggesting a high frequency of restraint-related and excited delirium-related fatalities.
Reference Type: Magazine Article
Author: Peters, John G
Year: 2006
Title: Sudden Death, "Excited" Delirium, and Issues of Force
Magazine: Police and Security News
Volume: 22
Issue Number: 3
Date: May/June
Short Title: Sudden Death, “Excited” Delirium, and Issues of Force
OBJECTIVES: The purpose of this study was to evaluate the cardiac consequences of neuromuscular incapacitating device (NID)/stun gun discharge in an experimental model. BACKGROUND: The large-voltage electrical discharges from NIDs have been suggested to pose a risk for triggering cardiac arrhythmias. METHODS: Intracardiac catheters and blood pressure transducers were inserted before the application of NID discharges in six anesthetized pigs. Two different commercially available models (NID-1 and NID-2), two different vectors of discharges (thoracic: parallel to the long axis of the heart on the chest wall, and nonthoracic: away from the chest, across the abdomen), and two different durations of discharge (5 and 15 s) were tested. The effect of simulated adrenergic stress using epinephrine was also evaluated. RESULTS: We studied a total of 150 discharges to 6 pigs; 74 of these discharges resulted in stimulation of the myocardium, as documented by electrical capture (mean ventricular rate during stimulation and capture, 324 +/- 66 beats/min). Of the 94 thoracic discharges, 74 stimulated the myocardium, compared with none from 56 nonthoracic discharges (p < 0.0001). During 16 discharges with epinephrine, there were 13 episodes of stimulation of the myocardium, of which 1 induced ventricular fibrillation and 1 caused ventricular tachycardia. Thoracic discharges from NID-1 were more likely to stimulate the myocardium than those from NID-2 (98% vs. 54%, p = 0.0007). CONCLUSIONS: In an experimental model, NID discharges across the chest can produce cardiac stimulation at high rates. This study suggests that NIDs may have cardiac risks that require further investigation in humans.
Reference Type: Report
Author: McDaniel, Wayne, Stratbucker, Robert
Year: 2006
Title: Testing the Cardiac Rhythm Safety of the Thoracic Application of TASER Devices
Institution: University of Missouri, MO, TASER International, Scottsdale, AZ
Short Title: Testing the Cardiac Rhythm Safety of the Thoracic Application of TASER Devices
Reference Type: Journal Article
Author: Lipley, N.
Year: 2006
Title: Set to stun
Journal: Emerg Nurse
Volume: 14
Issue: 5
Pages: 5
Date: Sep
Short Title: Set to stun
ISSN: 1354-5752 (Print)
Accession Number: 17002009
Keywords: Electricity/*adverse effects
Emergency Nursing/organization & administration
Emergency Treatment/*methods/nursing
Great Britain
Humans
*Immobilization/adverse effects/methods
Informed Consent/legislation & jurisprudence
Law Enforcement/*methods
Skin Care/methods/nursing
Notes: News
England
the journal of the RCN Accident and Emergency Nursing Association
URL:
Language: eng
Reference Type: Report
Author: Levine Saul, Loane, Christian, Chan, Thedore, Vilke, Gary
Year: 2006
Title: Cardiac Monitoring of Subjects Exsposed to the TASER
City: San Diego, California
Institution: University of California San Diego Dept of Emergency Medicine
Short Title: Cardiac Monitoring of Subjects Exsposed to the TASER
OBJECTIVES: This study sought to assess cocaine’s effects on Taser-induced ventricular fibrillation (VF) threshold in a pig model. BACKGROUND: Stun guns are increasingly used by law enforcement officials to restrain violent subjects, who are frequently intoxicated with cocaine and other drugs of abuse. The interaction of cocaine and the stun gun on VF induction is unknown. METHODS: We tested five adult pigs using a custom device built to deliver multiples of standard neuromuscular incapacitating (NMI) discharge that matched the waveform of a commercially available electrical stun gun (Taser X-26, Taser International, Scottsdale, Arizona). The NMI discharges were applied in a step-up and step-down fashion at 5 body locations. End points included determination of maximum safe multiple, minimum VF-inducing multiple, and ventricular fibrillation threshold (VFT) before and after cocaine infusion. RESULTS: Standard NMI discharges (x1) did not cause VF at any of the 5 locations before or after cocaine infusion. The maximum safe multiple, minimum VF-inducing multiple, and VFT of NMI application increased with increasing electrode distance from the heart. There was a 1.5- to 2-fold increase in these values at each position after cocaine infusion, suggesting decreased cardiac vulnerability for VF. Cocaine increased the required strength of NMI discharge that caused 2:1 or 3:1 ventricular capture ratios at all of the positions. No significant changes in creatine kinase-MB and troponin-I were seen. CONCLUSIONS: Cocaine increased the VFT of NMI discharges at all dart locations tested and reduced cardiac vulnerability to VF. The application of cocaine increased the safety margin by 50% to
100% above the baseline safety margin.

Notes: Journal Article
Research Support, Non-U.S. Gov't
United States

URL:

Language: eng
Abstract: An electronic weapon, the Taser M26, has recently entered the use-of-force continuum for police officers in England and Wales and is currently licensed for use by authorised firearms officers only. The aim of this report was to assess the relative risk of injury to officers and subjects of police use-of-force options and to evaluate whether the current positioning of the M26 in the use-of-force hierarchy is appropriate. We analysed use-of-force data from Northamptonshire Police Force and M26 field use data from TASER International. We found officer injury rates associated with M26 deployment were lower than those for CS spray and baton use. Subject injury rates were lower in M26 deployment than in deployment of CS spray, batons or police dogs. We suggest that the M26 should be made more widely available to police officers in the UK.
Abstract: Repeated exposure to electro-muscular incapacitating devices could result in repetitive, sustained muscle contraction, with little or no muscle recovery period. Therefore, rhabdomyolysis and other physiological responses, including acidosis, hyperkalaemia, and altered levels of muscle enzymes in the blood, would be likely to occur. Experiments were performed to investigate effects of repeated exposures of TASER International's Advanced TASER X26 on muscle contraction and resultant changes in blood factors in an anaesthetized swine model. A total of 10 animals were used. Six swine were exposed for 5 s, followed by a 5-s period of no exposure, repeatedly for 3 min. (In five of the animals, after a 1-h delay, a second 3-min exposure period was added.) The remaining four animals were used for an additional pilot study. All four limbs of each animal exhibited contraction even though the electrodes were positioned in areas at some distances from the limbs. The degree of muscle contraction generated during the second exposure period was significantly lower than that in the first exposure series. This
finding was consistent with previous studies showing that prolonged activity in skeletal muscle will eventually result in a decline of force production. There were some similarities in blood sample changes in the current experiments with previous studies of muscular exercise. Thus problems concerning biological effects of repeated TASER exposures may be related, not directly to the "electric output" per se, but rather to the resulting contraction of muscles (and related interruption of respiration) and subsequent sequelae. Transient increases in hematocrit, potassium, and sodium were consistent with previous reports in the literature dealing with studies of muscle stimulation or exercise. It is doubtful that these short-term elevations would have any serious health consequences in a healthy individual. Blood pH was significantly decreased for 1h following exposure, but subsequently returned toward a normal level. Leg muscle contractions and decreases in respiration each appeared to contribute to the acidosis. Lactate was highly elevated, with a slow return (time course greater than 1 h) to baseline. Other investigators have reported profound metabolic acidosis during restraint-associated cardiac arrest. Since restraint often occurs immediately after TASER exposure, this issue should be considered in further development of deployment concepts. On the basis of the results of the current studies, the repeated use of electro-muscular incapacitating devices in a short period of time is, at least, feasible, with the caveat that some medical monitoring of subjects may be required (to observe factors such as lactate and acidosis).

Notes: Journal Article
Research Support, U.S. Gov't, Non-P.H.S.
Ireland
URL:
Language: eng
OBJECTIVES: The TASER is a conducted electrical weapon (CEW) that has been used on people in custody. Individuals occasionally die unexpectedly while in custody, proximal to the application of a CEW. In this study, the authors sought to examine the effects of CEW application in resting adult volunteers to determine if there
was evidence of induced electrical dysrhythmia or direct cellular damage that would indicate a causal relationship between application of the device and in-custody death. 

METHODS: Human subjects (N = 66) underwent 24-hour monitoring after a standard CEW application. Blood samples were collected before and after exposure and again at 16 and 24 hours after exposure. A subpopulation (n = 32) had 12-lead electrocardiography performed at similar time intervals. Blood samples were analyzed for markers of skeletal and cardiac muscle injury and renal impairment. The electrocardiograms were read by a cardiologist blinded to the study. Data were analyzed using descriptive statistics. RESULTS: There was no significant change from baseline at any of the four time points for serum electrolyte levels and the blood urea nitrogen/creatinine ratio. An increase in serum bicarbonate and creatine kinase levels was noted at 16 and 24 hours. An increase in serum lactate level was noted immediately after exposure that decreased at 16 and 24 hours. Serum myoglobin level was increased from baseline at all three time points. All troponin levels measured were < 0.3 ng/mL, except for a single value of 0.6 ng/mL in a single subject. This subject was evaluated, and no evidence of acute myocardial infarction or disability was identified. At baseline, 30 of 32 electrocardiograms were interpreted as normal. The two abnormal electrocardiograms were abnormal at baseline and remained the same at all four time points.

CONCLUSIONS: In this resting adult population, the TASER X26 CEW did not affect the recordable cardiac electrical activity within a 24-hour period following a standard five-second application. The authors were unable to detect any induced electrical dysrhythmias or significant direct cardiac cellular damage that may be related to sudden and unexpected death proximal to CEW exposure. Additionally, no evidence of dangerous hyperkalemia or induced acidosis was found. Further study in the area of the in-custody death phenomenon to better understand its causes is recommended.

Notes: Clinical Trial 
Journal Article 
Research Support, Non-U.S. Gov't 
United States 
official journal of the Society for Academic Emergency Medicine 

URL:

Language: eng
Objective: The TASER X26 device is a conducted electrical weapon. It is used by law enforcement for control of agitated subjects by causing pain and/or neuromuscular incapacitation. There has been significant recent scrutiny of the TASER and its potential role in the death of subjects who have died while in custody. While there are numerous cases every year of in-custody deaths when no TASER has been applied, criticism of this device has occurred and a questionable causal relationship has been hypothesized. One hypothesis is that the TASER may induce death from cardiac dysfunction, arrhythmia or delayed myocardial damage. We sought to determine if human exposure to a standard TASER device causes any detectable change in serial 12-lead electrocardiograms.  

Methods: 32 volunteer subjects agreed to participate in the study. IRB approval was received prior to starting the project. After obtaining informed consent, all subjects had a 5-second TASER application with deployed probes from a distance of approximately 7 feet using a standard TASER X26 device. Serial electrocardiograms were performed on all subjects immediately before and immediately after TASER exposure and again at 16 and 24 hours after exposure. The electrocardiograms were interpreted by a blinded cardiologist. Results were tabulated for review. Results: At baseline 30/32 EKGs were interpreted as normal. The two abnormal EKGs (one was left ventricular hypertrophy and one was a sinus pause) remained unchanged at all four time points. No other EKG abnormalities were noted and no changes from baseline were detected. Conclusions: A 5-second TASER X26 application did not cause a detectable change in the 12-lead electrocardiograms of this sampled population. Theories of TASER induced dysrhythmic death or myocardial damage are not supported by our findings.

Link to PDF: internal-pdf://Ho Absence EKG-1956519424/Ho Absence EKG.pdf
Reference Type: Poster
Author: Ho, JD; Dawes, Donald; Thacker, Jenny; Lundin, Erik; Johnson, Mark
Year: 2006
Title: Beneficial Impact of Conducted Electrical Weapons in the Mentally Ill Population
Place Published: Hennepin County Medical Center, Minneapolis, MN
Short Title: Beneficial Impact of Conducted Electrical Weapons in the Mentally Ill Population
Link to PDF: internal-pdf://Ho, Jeffery, Dawes, Donald, Th-0288469248/Ho, Jeffery, Dawes, Donald, Thacker, Jenny, Lundin, Erik, Johnson, Mark.pdf
Reference Type: Report
Author: Davison N, Lewer N
Year: 2006
Title: Bradford Non-Lethal Weapons Research Project
City: Centre for Conflict Resolution Department of Peace Studies
Date: March
Short Title: Bradford Non-Lethal Weapons Research Project
Abstract: This report describes the features, treatment and outcome of globe perforation by a Taser dart electrode in a 21-year-old man. The Taser electrode caused mechanical iris, lens and retinal injury and consequent retinal detachment as result of proliferative vitreoretinopathy. The effect of electrical stimulation on ocular tissues is unknown. After the scleral and corneal wounds, traumatic cataract and retinal tear were repaired, the patient regained a visual acuity of 6/18. Nine months later a retinal detachment with proliferative vitreoretinopathy was discovered. The Taser may cause globe perforation and posterior segment injury. Understanding the barbed configuration of the dart electrode is important when extricating this device. Visual recovery is possible despite electric discharge of the Taser and suggests that the mechanism of ocular injury is largely mechanical.
Reference Type: Report
Author: Batts, Anthony W., Susanne Steiner
Year: 2006
Title: Less Lethal Weaponry Case Study
Institution: City of Long Beach
Pages: 4
Date: September 2006
Short Title: Less Lethal Weaponry Case Study
Reference Type: Report
Author: Wilkinson, David
Year: 2005
Title: PSDB Further Evaluation of TASER Devices
City: Hertfordshire, United Kingdom
Institution: United Kingdom Police Scientific Development Branch
Pages: 128
Date: 2005
Short Title: PSDB Further Evaluation of TASER Devices
Report Number: 19/05
Reference Type: Hearing
Year: 2005
Title: TASER Hearing Open Meeting
Committee: State of Wisconsin TASER Hearing
Date: April 19
Short Title: TASER Hearing Open Meeting
Reference Type: Report
Author: Toxicology Excellence for Risk Assessment (TERA), Andrew Maier, Patricia Nance, LINEA INC., General Dynamics, Clifford J Sherry, Metatec Associates, J Patrick Reily, Dr B JOn Klauenberg, Jonathan T Drummond LT Col USAF
Year: 2005
Title: Human Effectiveness and Risk Characterization of the Electromuscular Incapacitation Device – A Limited Analysis of the TASER Part I – Technical Report
Institution: The Joint Non-Lethal Weapons Human Effects Center of Excellence
Pages: 76
Date: March 1
Short Title: Human Effectiveness and Risk Characterization of the Electromuscular Incapacitation Device – A Limited Analysis of the TASER Part I – Technical Report
Reference Type: Personal Communication
Author: Titusville Police Department
Year: 2005
Title: Description of Incidents.
Short Title: Description of Incidents.
Reference Type: Report
Author: Tilton, Dennis San San Bernardino County Sheriffs Department
Year: 2005
Title: TASER Survey
City: San Bernardino
Institution: San Bernardino County Sheriffs Department
Pages: 98
Date: April 2005
Short Title: TASER Survey
Reference Type: Report
Author: The Florida Senate
Year: 2005
Title: Dart firing stun guns
Institution: The Florida Senate
Date: September 2005
Type: Interim Project Report 2006- 110
Short Title: Dart firing stun guns
Reference Type: Journal Article
Author: Strote, Jared, Shane Hamman, Rich Campbell, John Pease, H. Range Hutson
Year: 2005
Title: The Role of TASERs in Police Restraint-Related Death.
Short Title: The Role of TASERs in Police Restraint-Related Death.
Notes: Presented at the 2005 SAEM Conference
Stun guns are electric shocking devices that can be deployed as defensive or offensive weapons. The aim of this study was the identification of several types of trace evidence for corroborating deployment and providing clues to the weapon actually used. In a series of some 250 tests, the after-effects of firing a stun gun were studied under the differential influence of factors, such as time duration, distance from target, and bare skin vs clothing as target surface. Examination with scanning electron microscopy (SEM) and energy dispersive X-ray spectrometer (EDS) demonstrated the presence of metallic deposits corresponding to the electrodes of the device used. The observed differences in the number of these pellets were related to the length of deployment in seconds and to the distance of the weapon from the target surface. Longer duration of firing was consistently associated with a larger number of metallic deposits. Elemental composition of the latter provided clues to the type of device used and its current status in terms of wear and tear. Further trace evidence we examined included craters on the target surface and their pattern of dissemination on human skin, textiles, and leather. It is concluded that the use of carbon tabs for examination with SEM/EDS offers a practicable method for collecting trace material following stun gun deployment. Important groups of trace evidence do exist, and their collection and examination appear feasible.
Reference Type: Report
Author: San Jose Police Department. Davis, Chief Robert L. Davis
Year: 2005
Title: TASER Usage Update
City: San Jose
Institution: San Jose Police Department
Pages: 2
Date: 1 December 2005
Short Title: TASER Usage Update
Reference Type: Report
Author: Racht, Edward, Pat Cocker. Personal correspondence
Year: 2005
Title: TASER Clinical Risk Review
City: Austin
Institution: City of Austin/Travis County Emergency Medical Service System
Pages: 3
Date: 13 March 2005
Short Title: TASER Clinical Risk Review
PURPOSE: To describe the presentation and treatment of a Taser penetrating ocular injury. DESIGN: Case report. METHODS: A 50-year-old man with a Taser injury 1.5 cm below the right lower eyelid margin was admitted to the emergency department of a tertiary hospital. The case report describes the ophthalmic assessment, investigation, treatment, and outcome of the Taser barb penetrating ocular injury. RESULTS: The Taser has a fish hook barb that caused a full-thickness wound adequately large for vitreous to escape when the Taser was removed. Consequently, the scleral wound was repaired and cryopexy was performed. The affected eye made a satisfactory recovery, and the visual acuity was 6/9 with a pinhole 1 week after operation. CONCLUSIONS: Any Taser injury around the orbits should raise the suspicion of a penetrating ocular injury. In likely cases, removal of the Taser should be performed in an operating theater under general anesthesia.
Reference Type: Report
Author: Michigan Municipal Risk Management Authority Law Enforcement Advisory Committee
Year: 2005
Title: Less Lethal Weapons-Model Policy and Procedures for Public Safety Officers
Institution: Michigan Municipal Risk Management Authority
Date: Summer 2005
Short Title: Less Lethal Weapons-Model Policy and Procedures for Public Safety Officers
Reference Type: Report
Author: Miami-Dade County Grand Jury
Year: 2005
Title: Mental Illness and the Criminal Justice System: A Recipe for Disaster/A Prescription for Improvement
City: Miami
Pages: 51
Date: 11 January 2005
Type: Final Report
Short Title: Mental Illness and the Criminal Justice System: A Recipe for Disaster/A Prescription for Improvement
Reference Type: Report
Author: Mesloh, Charlie
Year: 2005
Title: TASER and Less Lethal Weapons: An Exploratory Analysis of Deployment and Effectiveness
Institution: Law Enforcement Executive Forum 2005
Short Title: TASER and Less Lethal Weapons: An Exploratory Analysis of Deployment and Effectiveness
Cardiac safety of neuromuscular incapacitating defensive devices

Neuromuscular incapacitation (NMI) devices discharge a pulsed dose of electrical energy to cause muscle contraction and pain. Field data suggest electrical NMI devices present an extremely low risk of injury. One risk of delivering electricity to a human is the induction of ventricular fibrillation (VF). We hypothesized that inducing VF would require a significantly greater NMI discharge than a discharge output by fielded devices. The cardiac safety of NMI discharges was studied in nine pigs weighing 60 +/- 28 kg. The minimum fibrillating level was defined as the lowest discharge that induced VF at least once, the maximum safe level was defined as the highest discharge which could be applied five times without VF induction, and the VF threshold was defined as their average. A safety index was defined as the ratio of the VF threshold to the standard discharge level output by fielded NMI devices. A VF induction protocol was applied to each pig to estimate the VF threshold and safety index. The safety index for stored charge ranged from 15X to 42X as weight increased from 30 to 117 kg (P < 0.001). Discharge levels above standard discharge and weight were independently significant for predicting VF inducibility. The safety index for an NMI discharge was significantly and positively associated with weight. Discharge levels for standard electrical NMI devices have an extremely low probability of inducing VF.
Reference Type: Personal Communication
Author: Martinez, Sgt Joe
Year: 2005
Title: TASER Medical Safety and Sudden Death Proximal to Restraint
Recipient: Martinez, Jose
City: Portland, OR
Publisher: Multnomah County Sheriffs Office
Pages: 10
Date: 7 October 2005
Short Title: TASER Medical Safety and Sudden Death Proximal to Restraint
Reference Type: Personal Communication
Author: Luceri, Richard; Caulkins, Hugh ; Kroll, Mark
Year: 2005
Title: An Open Letter to the Law Enforcement Community
Recipient: Consultants, Florida Arrhythmia
Short Title: An Open Letter to the Law Enforcement Community
Abstract: The Taser is a weapon that delivers high-voltage electricity and is used by approximately one third of U.S. law enforcement agencies. Although generally regarded as safe, little research exists in the literature despite reported sudden deaths. To our knowledge, no prospective human studies on the Taser exist. Objectives: To evaluate for cardiac changes utilizing monitoring during deployment of the Taser on healthy volunteers. Methods: This prospective, interventional pilot study was performed with police officers receiving training on the Taser X-26. The officers, all of whom had already volunteered to be "tapered," had continuous 3-lead electrocardiographic (ECG) monitoring immediately before, during, and after firing of the Taser. The mean duration of ECG tracing after shock was 16.3 seconds. Primary endpoints included development of changes in cardiac rate and rhythm, morphology, and intervals. Investigators individually analyzed the tracings. Comparative statistical analysis utilized paired Student's t-test and 95% confidence intervals (CIs). Results: Data were collected on 20 subjects. The mean shock duration was 2.4 seconds (range 1.2–5 s). Other than sinus tachycardia, no dysrhythmias were identified after the tasering. There was no change in morphology, QRS duration (range 40–80 msec), or QT interval (range 200–400 msec) between the before- and after-Taser groups. After the tasering, there was a 12-msec decrease (95% CI 6 to 18, p < 0.001) in the mean PR interval from 132 to 120 msec. The mean heart rates before and after being tasered were, respectively, 127 (range 80–160) and 142 (range 108–175). The mean increase in heart rate was 15 beats/min (95% CI 7 to 22; p < 0.001). Conclusions: In this pilot study we found no significant cardiac dysrhythmias in healthy human subjects immediately after receiving a Taser shock. In addition, there were no morphologic, rhythm, or interval changes other than a small decrease in PR interval and an increase in heart rate.
Reference Type: Journal Article
Author: Letter to the Editor
Year: 2005
Title: Ventricular Fibrillation after Stun-Gun Charge
Volume: 353:9
Date: September
Type of Article: Letter to the Editor
Short Title: Ventricular Fibrillation after Stun-Gun Charge
Reference Type: Journal Article
Author: Letter to the Editor
Year: 2005
Title: Withdrawal of TASER Electroshock Devices :Too Much, Too Soon:
Journal: Annals of Emergency Medicine
Volume: Volume 46
Issue: #3
Date: September, 2005
Type of Article: Letter the Editor
Short Title: Withdrawal of TASER Electroshock Devices :Too Much, Too Soon:
Reference Type: Report
Author: Laur, Darren
Year: 2005
Title: Excited Delirium and its Correlation to Sudden and Unexpected Death Proximal to Restraint: A Review of the Current and Relevant Medical Literature
Institution: Victoria Police Department
Date: April
Short Title: Excited Delirium and its Correlation to Sudden and Unexpected Death Proximal to Restraint: A Review of the Current and Relevant Medical Literature
Reference Type: Report
Author: International Association of Chiefs of Police, IACP
Year: 2005
Title: Electro-Muscular Disruption Technology: Nine Step Strategy for Effective Deployment.
Institution: International Association of Chiefs of Police
Short Title: Electro-Muscular Disruption Technology: Nine Step Strategy for Effective Deployment.
Reference Type: Report
Author: International Association of Chiefs of Police
Year: 2005
Title: Electronic Control Weapons (ECW’s) Update
Short Title: Electronic Control Weapons (ECW’s) Update
Reference Type: Magazine Article
Author: Ho, Jeffrey D.
Year: 2005
Title: Sudden In Custody Deaths
Magazine: Police Magazine
Date: August
Short Title: Sudden In Custody Deaths
Reference Type: Poster
Author: Ho, Jeffery D, Miner, James R., Heegaard, William G., Reardon, Robert F.
Year: 2005
Title: Deaths in American Police Custody: A 12 Month Surveillance Study
Place Published: University of Minnesota Emergency Medicine Program
Short Title: Deaths in American Police Custody: A 12 Month Surveillance Study
Reference Type: Electronic Article
Author: Force Science Research Center
Year: 2005
Title: FS News Readers Share Encounters With Naked Subjects
Periodical Title: Force Science Research Center
Volume: 16
Date Accessed: April 8
Access Date: Access Date
Reference Type: Electronic Article
Author: Force Science Research Center
Year: 2005
Title: Naked suspects: No Laughing Matter
Periodical Title: Force Science News
Volume: 16
Date Accessed: April 8
Access Date: Access Date
Abstract: Less lethal weapons are those used by law enforcement agencies to control behavior without causing significant injury or death. They include taser darts, pepper spray, tear gas, kinetic munitions, and light-sound diversion devices. Healthcare providers may be treating patients who have had these weapons deployed on them. Commonly, the effects of these weapons are minor; sometimes they can be deadly. This article reviews types of weapons, their anticipated and unanticipated effects, and how to treat patients who have sustained injuries resulting from their deployment. © 2005 Lippincott Williams & Wilkins, Inc.
Reference Type: Report
Author: Department of the Army
Year: 2005
Title: The U.S. Army Center for Health Promotion and Preventive Medicine’s Position on whether TASER is safe to use on U.S. Army Military and Civilian Personnel during Training
Date: February
Short Title: The U.S. Army Center for Health Promotion and Preventive Medicine’s Position on whether TASER is safe to use on U.S. Army Military and Civilian Personnel during Training
Reference Type: Journal Article
Author: Dearing, M.; Lewis, T. J.
Year: 2005
Title: Foreign body lodged in distal phalanx of left index finger-taser dart
Journal: Emerg Radiol
Volume: 11
Issue: 6
Pages: 364-5
Date: Nov
Short Title: Foreign body lodged in distal phalanx of left index finger-taser dart
Alternate Journal: Emergency radiology
ISSN: 1070-3004 (Print)
Accession Number: 16155754
Keywords: Adult
Electroshock/*instrumentation
Finger Injuries/*radiography
Foreign Bodies/*radiography
Humans
Male
Abstract: We report a case of a Taser dart presenting as a radio opaque foreign body to familiarize the Emergency Radiology community with the appearance of this non-lethal weapon which is being deployed in large numbers by police and security forces worldwide.
Notes: Case Reports
Journal Article
United States
URL:
Language: eng
Reference Type: Report
Author: Dallas Police Department
Year: 2005
Title: TASER Info at Lethal Force Level as of October 28, 2005
City: Dallas, TX
Pages: 2
Date: 28 October 2005
Short Title: TASER Info at Lethal Force Level as of October 28, 2005
Reference Type: Report
Author: City of Columbus, Ohio Division of Police
Year: 2005
Title: Six Month TASER Study
City: Columbus, OH
Institution: City of Columbus, Ohio Division of Police
Pages: 13
Date: July 5, 2005
Short Title: Six Month TASER Study
Reference Type: Report
Author: City of Cincinnati
Year: 2005
Title: Cincinnati Police Report to the Community TASER Devices
City: Cincinnati
Institution: City of Cincinnati
Pages: 2
Date: Fall 2005
Short Title: Cincinnati Police Report to the Community TASER Devices
Reference Type: Report
Author: Canadian Police Research Centre
Year: 2005
Title: Review of conducted energy devices
City: Ottawa, ON
Institution: Canadian Police Research Centre
Pages: 68
Date: August 22, 2005
Type: Technical Report
Short Title: Review of conducted energy devices
URL: www.cprc.org
Reference Type: Report
Author: Beach, City of Long
Year: 2005
Title: TASER Stun Device Proves To Be An Effective New Tool
City: Long Beach, CA
Pages: 1
Date: June 2005

Short Title: TASER Stun Device Proves To Be An Effective New Tool
On April 7, 2005, the Austin City Council heard a presentation concerning the City's policy on the use of Tasers, a brand of non-lethal weapon. Police Chief Stanley L. Knee discussed the use of Tasers, policy and an analysis of their use by Austin police. He was joined by Dr. Edward Racht, Emergency Medical Services Director; and Dr. Pat Crocker, director of emergency services for Brackenridge Hospital, who provided information about the medical implications of the use of the Tasers.
Reference Type: Report
Author: Ad Hoc Committee on Electronic Control Weapons, Adopted by the Georgia Association of Chiefs of Police Executive Board
Year: 2005
Title: Electronic Control Weapons Review and Recommendations
Institution: Ad Hoc Committee on Electronic Control Weapons, Adopted by the Georgia Association of Chiefs of Police Executive Board
Pages: 55
Date: 20 June 2005
Short Title: Electronic Control Weapons Review and Recommendations
URL: www.citydalton.net
Reference Type: Journal Article
Author: Stephens, Boyd G. M. D.; Jentzen, Jeffrey M. M. D.; Karch, Steven M. D.; Mash, Deborah C. PhD; Wetli, Charles V. M. D.
Year: 2004
Title: Criteria for the Interpretation of Cocaine Levels in Human Biological Samples and Their Relation to the Cause of Death
Journal: American Journal of Forensic Medicine & Pathology
Volume: 25
Issue: 1
Pages: 1-10
Short Title: Criteria for the Interpretation of Cocaine Levels in Human Biological Samples and Their Relation to the Cause of Death
Abstract: The determination that cocaine is directly responsible for the immediate cause of death should be considered only when there is a reasonably complete understanding of the circumstances or facts surrounding the death. Another, more obvious and immediate cause of death must be absent, or, at least cocaine must be shown to be a significant contributing factor in the chain of medical findings that lead directly to the immediate cause of death. Not all death investigation requires the sequential steps described in this paper, but these steps must be considered early on in the investigation whenever there is scene, investigational, medical or a historical basis to believe that cocaine is directly related to the cause of death. A relatively high profile death when cocaine is known to be involved, or a death involving unusual behavior on the part of the deceased with police involvement are examples where these considerations may well apply. Information needs to be obtained as soon as possible to have the highest chance of successfully documenting the toxicologic basis for the diagnosis. These facts would include, but would not necessarily be limited to, a scene investigation (whenever possible), a careful review of the investigative reports from all involved agencies, the initial core temperature of the body as well as that of the environment at the time of the collapse or death, the past medical history of the individual, and the results of a complete forensic autopsy and toxicologic studies. Knowledge of and an understanding of the current relevant forensic literature on this subject should be available to the reviewer prior to any interpretation of the significance of cocaine upon a specific death., (C) 2004 Lippincott Williams & Wilkins, Inc.
Notes: Review
Review. <2>
Reference Type: Report
Author: San Bernardino County Sheriffs Department
Year: 2004
Title: Program Evaluation of a pilot study of the TASER X26
City: San Bernardino
Institution: San Bernardino County Sheriffs Department
Date: 24 January 2004
Short Title: Program Evaluation of a pilot study of the TASER X26
Reference Type: Personal Communication
Author: Ross, Victor (Glendale, Colorado Police Department)
Year: 2004
Title: Use of Force Success
Recipient: Tuttle, Steve
City: Glendale, CO
Pages: 1
Date: 01 March 2004
Short Title: Use of Force Success
Reference Type: Report
Author: Rose, John
Year: 2004
Title: Navigating the Learning Curve
Institution: Cincinnati Police Department
Pages: 17
Short Title: Navigating the Learning Curve
Reference Type: Magazine Article
Author: McManus, John, et al
Year: 2004
Title: A Retrospective Case Series Describing the Injury Pattern of the Advanced TASER M26 in Multnomah County Oregon.
Magazine: Society of Academic Emergency Medicine
Volume: Volume 11
Issue Number: Number 5
Short Title: A Retrospective Case Series Describing the Injury Pattern of the Advanced TASER M26 in Multnomah County Oregon.
Reference Type: Presentation
Author: Jauchem, J
Year: 2004
Title: Effectiveness & Health Effects of Electro-Muscular Incapacitating Devices
Publisher: Air Force Research Laboratory
Date: November
Short Title: Effectiveness & Health Effects of Electro-Muscular Incapacitating Devices
OBJECTIVES: To determine the length of catheter required to perform a needle thoracostomy, as determined by chest wall thickness, to treat the majority of patients presenting to the emergency department (ED) with a potential tension pneumothorax. METHODS: A convenience sample of 111 computed tomography (CT) scans of the chest in trauma and medical resuscitation patients at a military Level 1 trauma center in San Antonio, Texas, was pooled, and the chest wall thickness was measured at the second intercostal space, midclavicular line, to the nearest 0.1 cm. RESULTS: The mean chest wall thickness in the patients studied averaged 4.24 cm (95% confidence interval [CI] = 3.97 to 4.52). Nearly one fourth (25) of the study patients had a chest wall thicker than 5 cm. Women, on average, have thicker chest walls than men (4.90 for women; 4.16 for men; p = 0.022). CONCLUSIONS: In this study, a catheter length of 5 cm would reliably penetrate the pleural space of only 75% of patients. A longer catheter should be considered, especially in women.
Reference Type: Magazine Article
Author: Force Science Research Center Minnesota State University, Mankato
Year: 2004
Title: Should Cops Stop Using TASER's?
Magazine: Force Science News
Issue Number: 8
Pages: 4
Date: 12 December 2004
Short Title: Should Cops Stop Using TASER's?
URL: www.forcescience.org
This research attempts to break down violent law enforcement/citizen confrontations into a series of events, which will allow us to determine the effect of specific less lethal weapons in the final outcomes. We were also able to test the validity of some commonly held assumptions in law enforcement use of force and provide quantitative findings that law enforcement agencies can use to base policy decisions upon. Findings specific to this study are highlighted.
Reference Type: Report  
Record Number: 217  
Author: Cincinnati Police Department  
Year: 2004  
Title: How Tasers Are Used by the Cincinnati PD  
Institution: Cincinnati Police Department  
Pages: 3  
Short Title: How Tasers Are Used by the Cincinnati PD

Reference Type: Personal Communication  
Author: Cincinnati Ohio Police Department, Ventre, Douglas C.  
Year: 2004  
Recipient: TASER  
City: Cincinnati  
Publisher: City of Cincinnati Police Department  
Pages: 1  
Date: 27 July 2004

Reference Type: Report  
Author: Charlotte-Mecklenburg Police Department  
Year: 2004  
Title: TASER Project First Year-Full Deployment  
City: Charlotte-Mecklenburg  
Institution: Charlotte-Mecklenburg Police Department  
Pages: 12  
Date: December 2004  
Short Title: TASER Project First Year-Full Deployment

Reference Type: Report  
Author: Chandler Arizona Police Department  
Year: 2004  
Title: Advanced TASER Use of Force 2003 Annual Report April 1 – December 31  
City: Chandler, AZ  
Institution: Chandler Police Department  
Pages: 12  
Date: 03 February 2004  
Short Title: Advanced TASER Use of Force 2003 Annual Report April 1 – December 31
Reference Type: Report
Record Number: 202
Author: Chairman, DSAC Sub-Committee on Medical Implications of Less Lethal Weapons
Year: 2004
Title: United Kingdom DOMILL Report on TASER M26 Medical Implications
Institution: DSAC Sub-Committee on Medical Implications of Less lethal Weapons
Pages: 7
Date: March 2004
Short Title: United Kingdom DOMILL Report on TASER M26 Medical Implications

Reference Type: Personal Communication
Author: Cape Coral Florida Police Department, Connelly, Bart
Year: 2004
Title: M26 Air TASER Program Evaluation
Recipient: Dan Alexander, Chief of Police
Publisher: Cape Coral Police Department Professional Standards Bureau
Pages: 9
Date: 22 September 2004
Short Title: M26 Air TASER Program Evaluation
Reference Type: Report
Author: Butler, Charles F
Year: 2004
Title: TASER Report TASER Report A Medical/Safety Review of the TASER Prepared for the Kalamazoo County Sheriff's Department
Institution: Kalamazoo County Sheriff's Department
Pages: 10
Short Title: TASER Report TASER Report A Medical/Safety Review of the TASER Prepared for the Kalamazoo County Sheriff's Department
The Taser is a development of the stun gun. It has recently been introduced into British policing as a "less lethal" weapon to fill the operational gap between the baton and the gun for controlling potentially dangerous and violent suspects. It is inevitable that "tasered" victims will be brought to hospitals. A review of clinical experience with electronic weaponry is presented. Suggestions for managing "tasered" subjects are provided.
Reference Type: Report
Author: Zurich Switzerland Police Scientific Service
Year: 2003
Title: WD Statement Regarding TASER
Pages: 3
Date: 07 July 2003
Short Title: WD Statement Regarding TASER
Abstract: The author autopsied a seven-month-old infant who was shocked repeatedly with a stun gun by his foster mother, in an attempt by the foster mother to get the infant to stop crying. The stun gun injuries were round, well-circumscribed, erythematous macular lesions, which were found in pairs. The lesions were 2 in. apart, and were found to match the distance between the electrodes of the stun gun found in the foster mother's purse. Based on the electrical output of the stun gun, the small size of the infant, location of stun gun discharge, and the decreased resistance of the infant's skin, it can be concluded that the stun gun injury is responsible for the infant's death.
Reference Type: Report
Author: The Alfred Hospital
Year: 2003
Title: Advanced TASER X-26 Safety Analysis
Pages: 28
Date: 29 June 2003
Short Title: Advanced TASER X-26 Safety Analysis
Reference Type: Report
Author: The Alfred Hospital
Year: 2003
Title: Advanced TASER M-26 Safety Analysis
Institution: The Alfred Hospital
Pages: 26
Date: 22 September 2003
Short Title: Advanced TASER M-26 Safety Analysis
The author reviews literature pertaining to the efficacy and safety of electroconvulsive therapy (ECT), with emphasis on the controversy concerning whether ECT causes brain damage. ECT does appear to be effective in the treatment of severe depression and possibly mania. The types of memory problems caused by ECT are discussed, and evidence suggests that most of these deficits are transitory. Although most evidence points toward modern ECT not causing brain damage, there are still some findings that raise questions about safety. Ethical issues involving this treatment's use, its availability to the public, and informed consent procedures are discussed.
Reference Type: Magazine Article
Author: Letter to the Editor
Year: 2003
Title: EMS Providers Express Concern over Stun Guns
Magazine: Journal of the Emergency Medical Services
Date: December
Short Title: EMS Providers Express Concern over Stun Guns
Abstract: Less lethal is a technology ubiquitous to law enforcement. It capitalizes on the use of technology to subdue, confuse, and control with less force than traditional firearms present. Injuries can and do occur with these tools, and understanding their uses, patterns of injury, and treatment is important not only for the law enforcer but the medical provider as well. The article discusses compressed air technology, conducted energy weapons, extended range impact projectiles, noise flash diversion devices, and chemical agents. (C) 2003 Lippincott Williams & Wilkins, Inc.

Notes: Miscellaneous

Language: English.
Summary: The purpose of this report is to review the evidence that physical inactivity and excess adiposity are related to an increased risk of all-cause mortality, and to better identify the independent contributions of each to all-cause mortality rates. A variance-based method of meta-analysis was used to summarize the relationships from available studies. The summary relative risk of all-cause mortality for physical activity from the 55 analyses (31 studies) that included an index of adiposity as a covariate was 0.80 [95% confidence interval (CI) 0.78-0.82], whereas it was 0.82 [95% CI 0.80-0.84] for the 44 analyses (26 studies) that did not include an index of adiposity. Thus, physically active individuals have a lower risk of mortality by comparison to physically inactive peers, independent of level of adiposity. The summary relative risk of all-cause mortality for an elevated body mass index (BMI) from the 25 analyses (13 studies) that included physical activity as a covariate was 1.23 [95% CI 1.18-1.29], and it was 1.24 [95% CI 1.21-1.28] for the 81 analyses (36 studies) that did not include physical activity as a covariate. Studies that used a measure of adiposity other than the BMI show similar relationships with mortality, and stratified analyses indicate that both physical inactivity and adiposity are important determinants of mortality risk. (C) 2003 Blackwell Science Ltd.
Reference Type: Report
Author: Fales, William
Year: 2003
Title: Medical Considerations for TASER Operations
City: Kalamazoo, MI
Institution: Kalamazoo County Medical Control Authority
Pages: 2
Date: 9 December 2003
Short Title: Medical Considerations for TASER Operations
Reference Type: Report
Author: Driscoll, Patrick
Year: 2003
Title: Kinetic Impact Munitions and TASER Guns: Two Less Lethal Weapons Options for the Wayne County Airport Police Department
Institution: Wayne County Airport Police Department; Eastern Michigan University
Pages: 24
Date: 19 September 2003
Short Title: Kinetic Impact Munitions and TASER Guns: Two Less Lethal Weapons Options for the Wayne County Airport Police Department
Reference Type: Report
Record Number: 238
Author: Denver Police Department
Year: 2003
Title: Use of Force Reports for May and June 2003
City: Denver, CO
Institution: Denver Police Department
Date: May and June 2003
Short Title: Use of Force Reports for May and June 2003

Reference Type: Personal Communication
Record Number: 241
Author: Brown, Ted R. (Orange County Sheriff's Office)
Year: 2003
Title: Request for TASER Information From the Citizen's Review Board
Recipient: Behnke, Captain Lynn
City: Orange County
Pages: 3
Date: 23 January 2003
Short Title: Request for TASER Information From the Citizen's Review Board

Reference Type: Report
Record Number: 187
Author: Bleetman, Anthony, Richard Steyn
Year: 2003
Title: The Advanced TASER: A Medical Review
Institution: University of Birmingham, UK
Pages: 30
Date: April 2003
Short Title: The Advanced TASER: A Medical Review
Histological changes of the skin following electrical injury with a stun gun have rarely been described. We report the case of a 61-year-old man who died after having been tortured with a stun gun during a robbery. At autopsy two reddish, dot-like lesions were found on the chest and histological examination revealed electric current-related changes. Only a few reports concerning micromorphological cutaneous changes following stun gun injury have been reported; therefore further investigations concerning the frequency and type of histological findings due to stun gun injuries will be necessary in order to provide sufficient characteristic data for a conclusive interpretation.
Reference Type: Report
Record Number: 246
Author: Seattle Police Department
Year: 2002
Title: Update on TASER Usage as of 14 November 2002
Institution: Seattle Police Department
Pages: 7
Date: November 2002
Type: Special Report
Short Title: Update on TASER Usage as of 14 November 2002

Reference Type: Report
Record Number: 194
Author: Northern Ireland Office, Association of Chief Police Officers
Year: 2002
Title: A Research Programme into Alternative Policing Approaches Towards the Management of Conflict
Institution: Northern Ireland Office, Association of Chief Police Officers
Pages: 7
Date: December, 2002
Short Title: A Research Programme into Alternative Policing Approaches Towards the Management of Conflict
The purpose of this article is to identify and rank factors associated with sudden death of individuals requiring restraint for excited delirium. Eighteen cases of such deaths witnessed by emergency medical service (EMS) personnel are reported. The 18 cases reported were restrained with the wrists and ankles bound and attached behind the back. This restraint technique was also used for all 196 surviving excited delirium victims encountered during the study period. Unique to these data is a description of the initial cardiopulmonary arrest rhythm in 72% of the sudden death cases. Associated with all sudden death cases was struggle by the victim with forced restraint and cessation of struggling with labored or agonal breathing immediately before cardiopulmonary arrest. Also associated was stimulant drug use (78%), chronic disease (56%), and obesity (56%). The primary cardiac arrest rhythm of ventricular tachycardia was found in 1 of 13 victims with confirmed initial cardiac rhythms, with none found in ventricular fibrillation. Our findings indicate that unexpected sudden death when excited delirium victims are restrained in the out-of-hospital setting is not infrequent and can be associated with multiple predictable but usually uncontrollable factors. (Am J Emerg Med 2001;19:187-191. Copyright (C) 2001 by W.B. Saunders Company), (C) 2001 W.B. Saunders Company, a Harcourt Health Sciences Company
Reference Type: Personal Communication
Author: McDaniel, Wayne C
Year: 2001
Title: Dual TASER Discharge
Publisher: University of Missouri
Date: April 10
Short Title: Dual TASER Discharge
Reference Type: Journal Article
Author: Gould, M.
Year: 2001
Title: UK civil rights groups question safety of stun guns
Journal: Bmj
Volume: 323
Issue: 7308
Pages: 300
Date: Aug 11
Short Title: UK civil rights groups question safety of stun guns
Alternate Journal: BMJ (Clinical research ed
ISSN: 0959-8138 (Print)
Accession Number: 11498478
Keywords: *Civil Rights
Firearms
Great Britain
Humans
Social Control, Formal/*methods
Notes: News
England
&list_uids=11498478
Language: eng

Reference Type: Journal Article
Record Number: 114
Author: Fish, R. M.; Geddes, L. A.
Year: 2001
Title: Effects of stun guns and tasers
Journal: Lancet
Volume: 358
Issue: 9283
Pages: 687-8
Date: Sep 1
Short Title: Effects of stun guns and tasers
A number of "less lethal" weapons have been developed and are commonly used by modern law-enforcement agencies and some military organizations. The intent of these weapons is to subdue or incapacitate violent or dangerous suspects without
causing serious harm or death. Commonly used less lethal weapons include chemical irritant agents, explosive distraction devices, kinetic impact munitions, and electrical incapacitation devices. While less lethal weapons are significantly safer than traditional firearms, no weapon can be entirely non-lethal and no weapon can be made entirely safe. Medical providers may treat subjects exposed to less lethal weapons and should presume injury until proven otherwise. The following is a review article on the medical aspects of less lethal weapons.
Use of stun guns for venomous bites and stings: a review

Abstract: During the past 2 decades, articles suggesting that stun guns be utilized to treat venomous bites and stings have appeared in both the lay and medical press. Although never widely considered to be standard therapy for venomous bites and stings, stun guns are still considered to be a treatment option by some medical practitioners and outdoor enthusiasts. A Medline search was performed using these terms: venomous bites, venomous stings, snake bites, spider bites, electrical, stun gun, high voltage electricity, low amperage electricity, direct current, and shock therapy. Articles selected included laboratory-based isolated venom studies, animal studies, and case reports involving humans in which a stun gun or some other source of high voltage, low amperage direct current electric shocks were used to treat actual or simulated venomous bites or stings. We concluded that the use of stun guns or other sources of high voltage, low amperage direct current electric shocks to treat venomous bites and stings is not supported by the literature.
The authors tested whether use of an electro shock weapon (stun gun) leaves marks on skin which can be found in an exterior examination. On pig skin such marks could not be produced postmortally. An experiment on one of the authors caused reddish skin marks which persisted for about 2 h. Inability to act as promised by the weapons' manufacturers did not occur in our experiments, exactly as previously described by other authors. Use of an air tester which shoots barbed electrodes ought to produce bleedings if the electrodes actually penetrate the skin.
Reference Type: Journal Article
Author: Layman, Eve L. R. N. PhD
Year: 2000
Title: How Therapeutic Are Tasers?
Journal: Journal of the American Psychiatric Nurses Association
Volume: 6
Issue: 3
Pages: 97-99
Short Title: How Therapeutic Are Tasers?
Notes: Miscellaneous
Miscellaneous.
Reference Type: Personal Communication
Author: Harrison, Robert G.
Year: 2000
Title: ADVANCED TASER® M26 LESS LETHAL SYSTEM
Recipient: TASER
City: Ottawa
Pages: 6
Description: A review of the literature and conclusion.
Date: 14 February 2000
Short Title: ADVANCED TASER® M26 LESS LETHAL SYSTEM
Reference Type: Personal Communication
Author: Hendry, P.
Year: 1999
Title: Personal Correspondance
Recipient: TASER
City: Ottawa
Publisher: University of Ottawa Heart Insti
Pages: 1
Description: Opinion on the medical safety of the TASER in regard to patients with either pacemakers or implantable defibrillators.
Date: 28 September 1999
Type: Letter
Short Title: Personal Correspondance
Stun gun injury

A case is presented of injury by a "stun gun." The different types of electric shock devices produced commercially are summarised and the potential injuries discussed.
Abstract: We determined the effect of cocaine on ventricular vulnerability to fibrillation, as measured by ventricular fibrillation threshold (VFT), and cardiac electrophysiology in 20 anesthetized dogs with normal hearts. Animals were randomized in blinded fashion to receive a continuous 3-hour infusion of cocaine 0.11 mg/kg/minute (total dose 20 mg/kg) or placebo (lactose dissolved in normal saline). The VFT, systolic and diastolic blood pressures, ventricular effective refractory period (ERP), and electrocardiographic intervals were measured at baseline and every 30 minutes during infusion. Baseline mean +/- SE VFT in cocaine and placebo groups was 57.0 +/- 7.8 and 51.8 +/- 7.6 mA, respectively (p = 0.64). Cocaine did not significantly decrease VFT, but actually increased it (i.e., reduced ventricular vulnerability to fibrillation) compared with placebo (84.6 +/- 10.4 vs 55.8 +/- 7.2 mA, respectively, at 150 minutes, p = 0.04). Cocaine prolonged ERP and PR, QRS, QT, QTc, JT, and JTc intervals. Cocaine does not increase ventricular vulnerability to fibrillation in anesthetized dogs with normal intact hearts. Its electrophysiologic effects are similar to those of class I antiarrhythmic agents in this model.
Laboratory rats injected daily with a moderate dose of cocaine hydrochloride (30 mg/kg, i.p.) showed increased fatalities when cocaine injections were followed by 30 min of restraint stress. The 5-day mortality rate was 58% for the cocaine-plus-stress group, while 17% of the animals receiving cocaine without restraint stress died. This finding suggests that stress can augment the toxic effect of cocaine and that minimizing stress may be an important consideration in the clinical management of cocaine overdose.
Abstract: Earlier parts of this series have discussed the physics, pathophysiology, and nature of electric injury. This part will discuss deliberately applied electric shocks and the treatment of electric injuries. Electric shocks are deliberately applied to persons during electroshock therapy and with stun guns, shock batons, and electric cattle prods. Electric injuries, whether a complication of deliberate electric shock or due to accidental injury, should be treated to preserve cardiac and respiratory function and to prevent further tissue damage. Safe extrication at the scene, rapid triage, and emergency medical treatment are discussed.
Reference Type: Journal Article  
Author: Mehl, L. E.  
Year: 1992  
Title: Electrical injury from Tasering and miscarriage  
Journal: Acta Obstet Gynecol Scand  
Volume: 71  
Issue: 2  
Pages: 118-23  
Date: Feb  
Short Title: Electrical injury from Tasering and miscarriage  
Alternate Journal: Acta obstetricia et gynecologica Scandinavica  
ISSN: 0001-6349 (Print)  
Accession Number: 1316038  
Keywords: Abortion, Spontaneous/*etiology  
Adult  
Electric Injuries/*complications/*physiopathology  
Female  
Humans  
Lightning Injuries/complications  
Muscle Contraction/*physiology  
Police  
Pregnancy  
Pregnancy Outcome  
Abstract: A case report is presented of a woman who was "Tasered" by law enforcement personnel while 12 weeks pregnant. The Taser (Thomas A. Swift's Electric Rifle) is an electronic immobilization and defense weapon that has been commercially available since 1974. The Taser was developed as an alternative to the .38 special handgun. The patient was hit with Taser probes in the abdomen and the leg. She began to spontaneously miscarry 7 days later and received a dilatation and curettage procedure 14 days later for incomplete abortion. The world's literature on electrical and lightning injury to pregnant women is reviewed, and the mechanism of action of Taser injury is discussed. As use of the Taser becomes more common, obstetrical clinicians may encounter complications from the Taser more often.  
Notes: Case Reports  
Journal Article  
Review  
Denmark  
URL:  
Language: eng
Abstract: Stun guns are electric shock devices that are used by a number of law enforcement agencies to subdue violent offenders, but sometimes are discharged into human bodies as offensive weapons. We autopsied a 22-year-old woman who was strangled and had many stun-gun injuries on her head, chest, abdomen, arms, and legs. The stun-gun injuries consisted of many pairs of round erythemas with or without central paleness, some of which were accompanied by circumferential abrasions. To determine whether the electric shocks were administered before or after her death, we studied stun-gun injuries on pigs before and after death and found that the shocks after death did not mark the animal skin. Based on this experiment, all of the stun-gun injuries on the victim's body were concluded to have been inflicted before her death.
Stun guns are self-protection devices that are increasingly available with few restrictions on their use and sale. We present a case of child abuse with a stun gun. The signs of such abuse are often subtle, and they may be underrecognized currently. The skin lesions that are often seen are hypopigmented circular macules, measuring approximately 0.5 cm in diameter. They may be raised slightly and erythematous if inflicted recently. Most characteristic of stun gun assault is pairing of lesions approximately 5 cm apart. We discuss the design, operation, and effects of stun guns, and give an extensive differential of abusive and nonabusive circular lesions.
Electronic weaponry--a question of safety

Abstract: Electronic weapons represent a new class of weapon available to law enforcement and the lay public. Although these weapons have been available for several years, there is inadequate research to document their safety or efficacy. Two of the most common, the TASER and the stun gun, are reviewed. The electronic weapon was initially and still is approved by the US Consumer Product Safety Commission; its approval was based on theoretical calculations of the physical effects of damped sinusoidal pulses, not on the basis of animal or human studies. These devices are widely available and heavily promoted, despite limited research into their safety or efficiency and despite recent animal studies documenting their potential for lethality.
Reference Type: Thesis
Author: Meyer, Greg
Year: 1991
Title: Non-Lethal Weapons Versus Conventional Police Tactics: The Los Angeles Police Department Experience
Academic Department: Political Science
City: Los Angeles
University: California State University
Number of Pages: 80
Date: March 1991
Short Title: Non-Lethal Weapons Versus Conventional Police Tactics: The Los Angeles Police Department Experience
Abstract: Sixteen deaths associated with the use of the Taser were examined. All involved young males who had a history of abuse of controlled substances; all but three were under the influence of cocaine, phencyclidine [phenylcyclohexylpiperidine (PCP)], or amphetamine. All were behaving in a bizarre or unusual fashion which necessitated calling the police. The cause of death was an overdose of drugs in eleven, gunshot wounds in three, heart disease and Taser shock in one, and an undetermined cause in one. All were considered to be under the influence of PCP by the police at the time of the incident. All were unarmed, which was the reason a Taser was used instead of a more lethal weapon. The conclusion reached after evaluation of these cases is that the Taser in and of itself does not cause death, although it may have contributed to death in one case.

Notes: Journal Article


Language: eng
Abstract: The regular playing of racquet sports tends to confer general health and to protect the heart—to produce the athletic heart syndrome. Strenuous play, however, can provoke ventricular arrhythmias and can kill individuals with heart disease. The overall risk for an exercise death from racquet sport play seems to be as low as from distance running. Middle-aged men, however, especially those with known coronary disease or coronary risk factors, should approach racquet sports with caution, and might benefit from timely medical advice. [References: 15]
Abstract: The Taser is an electrical weapon used for immobilization. Two hundred eighteen patients who were shot by police with a Taser for violent or criminal behavior were compared to 22 similar patients shot by police with .38 Specials. The long-term morbidity rate was significantly different for "tasered" victims (0%) and for those with bullet wounds (50%) (P less than .05). The mortality rate was also significantly different between "tasered" victims (1.4%), and gunshot wound victims (50%) (P less than .05). Possible complications associated with Taser wounds included contusions, abrasions, and lacerations (38%); mild rhabdomyolysis (1%); and testicular torsion (0.5%). Although 48% of "tasered" patients required hospitalization, all but one was for a preexisting injury or toxic or psychiatric problem. We conclude that Tasers are relatively safe when compared to shooting with more conventional weapons.
Abstract: The Taser is a relatively new electronic self-defense and immobilization weapon used by the public and by law enforcement agencies. Taser victims characteristically have an altered mental status due to drug ingestion or primary psychiatric illness. An unexpected case of Taser-associated morbidity, that of voluntary Taser dart ingestion in a patient with paranoid delusions, is reported. Near mismanagement due to unfamiliarity with the Taser occurred. Recommendations for diagnosis and management are discussed. The emergency physician should be aware of the potential of this unusual ingestion.

Notes: Case Reports
Journal Article
United states

URL:

Language: eng
The Taser is an electrical law enforcement and self-defense weapon that is being used with increasing frequency. The weapon is described and its effects and ballistic and electrical considerations are reviewed. Clinical aspects of Taser injury, including weapon-fired barb injury, barb removal methods, injury secondary to electrical current, ventricular fibrillation, possible interactions with implanted pacemakers, and injuries secondary to weapon-induced falls, are discussed. Taser injuries are a new and increasingly frequent emergency medicine problem.
Reference Type: Report
Author: Bernstein, Theodore
Year: 1985
Title: Evaluation of the Electric Shock Hazard for the NOVA XR 5000 Stun Gun
Institution: University of Wisconsin-Madison
Date: January 22
Short Title: Evaluation of the Electric Shock Hazard for the NOVA XR 5000 Stun Gun
Reference Type: Personal Communication
Author: Zylich, Neil P
Year: 1976
Title: TASER Evaluation and Analysis
Publisher: U.S. Product Safety Commission
Description: U.S. Government Memorandum
Date: February 19
Short Title: TASER Evaluation and Analysis
Reference Type: Personal Communication
Author: Fandey, Joseph Z. et al
Year: 1976
Title: TASER TF-1, CP76-5 U.S. Product Safety Commission
Publisher: Letter Office of the Medical Director
Date: February 10
Short Title: U.S. Government Memorandum
Reference Type: Personal Communication
Author: Bernstein, Theodore
Year: 1976
Title: Letter to the Consumer Product Safety Commission
Recipient: Commission, Consumer Product Safety
Publisher: University of Wisconsin-Madison
Description: Personal correspondence
Date: February 12, 1976
Short Title: Letter to the Consumer Product Safety Commission
Reference Type: Personal Communication
Author: Jeanette Michael
Year: 1975
Title: Jurisdiction over the TASER Public Defender
Publisher: U.S. Product Safety Commission, U.S. Government Memorandum
Date: November 7
Short Title: Jurisdiction over the TASER Public Defender
Reference Type: Report
Author: Underwriters' Laboratories, Inc
Year: 1939; 1955
Title: Electric Shock as it Pertains to the Electric Fence
Institution: National Board of Fire Underwriters Bulletin of Research
Document Number: 14
Pages: 55
Date: December
Short Title: Electric Shock as it Pertains to the Electric Fence
Reference Type: Journal Article
Author: Kester, Don; ljames, Steve
Title: Patterns of Injury, Recognition, and Treatment for Less Lethal Law Enforcement Techniques
Short Title: Patterns of Injury, Recognition, and Treatment for Less Lethal Law Enforcement Techniques
Abstract: Less lethal is a technology ubiquitous to law enforcement. It capitalizes on the use of technology to subdue, confuse, and control with less force than traditional firearms present. Injuries can and do occur with these tools, and understanding their uses, patterns of injury, and treatment is important not only for the law enforcer but the medical provider as well. The article discusses compressed air technology, conducted energy weapons, extended range impact projectiles, noise flash diversion devices, and chemical agents., (C) 2003 Lippincott Williams & Wilkins, Inc.
Notes: Miscellaneous
Miscellaneous. <3>