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COLLECTIVE REVIEW

Use of stun guns for venomous bites and stings: a review

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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.

Key words: venoms, arthropod venoms, snake venoms, viper venoms, antivenoms, electric stimulation therapy

Introduction

Some articles published in the lay and medical literature during the past 2 decades have recommended the use of electronic immobilization devices, commonly referred to as stun guns, in the treatment of venomous bites or stings. Stun guns are designed to deliver high voltage (25 000–100 000 kV), low amperage (<4.5 A), short duration (≈20 microseconds), repetitive (5–20 pulses per second) shocks when in contact with the victim's skin. The devices develop more difficult to control, higher amperage (≤190 A) shocks when administered over an air gap or through thick clothing. Stun gun shocks stimulate superficial nervous system tissue, resulting in repetitive muscular contractions, pain, numbness, ataxia, and confusion. Stun gun shock duration of 0.5 seconds usually startles the victim, thus limiting their advancement. Stun gun shock duration of 1–2 seconds usually causes the victim to lose balance, resulting in a fall. Stun gun shock duration of 3–5 seconds causes the involved musculature to become temporarily (≤15 minutes) unresponsive to voluntary central nervous system control and leaves the victim incapacitated.[1–3] Over 7000 stun guns were sold prior to the Food and Drug Administration banning the advertising of stun guns for the treatment of bites and stings in April 1990. Stun guns, although previously advertised for the treatment of venomous bites or stings, have never been licensed by the Food and Drug Administration for the treatment of any medical condition.[4] Stun guns remain commercially available and are marketed as personal protection devices.

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Spider bites

In 1999, sixty-four poison control centers fielded 15 139 calls concerning spider bites. Common sources of spider bites included unidentified spiders (66.4%), widow spiders (*Latrodectus* spp; 16.3%) and brown recluse spiders (*Loxosceles* spp; 15.9%). Two deaths attributed to *Loxosceles* spp were reported in 1999.[5] The spiders most commonly associated with significant bites are *Latrodectus* spp and *Loxosceles* spp.[6–8] In a letter to the editor, Russell and Gertsch describe their experiences treating what were diagnosed as probable brown recluse spider bites. The authors found that 80% of suspected spider bites were not actually spider bites and that accurately

diagnosed spider bites were usually attributable to non-*Loxosceles* spp spiders.[8] To date, no information, either scientific or anecdotal, has been published concerning the use of high voltage direct current (HVDC) therapy for documented *Latrodectus* spp bites.

Carl D. Osborn, an Oklahoma gynecologist, wrote the majority of information detailing the use of HVDC shock therapy for spider bites in humans. In a series of 3 articles and 1 letter published in the *Journal of the Oklahoma Medical Association,* Osborn describes his experience with HVDC therapy.[9–12] In the first article, Osborn describes his HVDC delivery device as a hand held stun gun (45–50 kV, 4.5 mA) and an extension wire. The extension wire was utilized to allow the transfer of HVDC through large and irregular shaped lesions. Brief case summaries of 21 patients who received HVDC shock therapy for spider bites over a 13-month period are detailed in the body of the article. In only 5 cases was a spider (3 brown recluse, 1 wolf [*Lycosa*], and 1 unidentified spider) seen at or near the time the bite was thought to occur. The remaining 16 cases were diagnosed as spider bites on the basis of the clinical appearance of the lesion. Patients received between 2 and 12 total HVDC shocks, with 6 shocks the most common. The lesions were typically shocked twice through the lesion and twice across the lesion in a cross pattern for 1 to 2 seconds per shock. As early as 4 hours and as late as 1 month (mean ≈3 days) after the alleged bites, HVDC therapy was initiated. Patients frequently received corticosteroids (13 patients) and antibiotics (6 patients) in addition to HVDC therapy. The author reported that all patients experienced quick and dramatic reductions in pain and that no extension of tissue damage occurred after HVDC therapy. Curiously, 6 patients (29%) received a second course of HVDC therapy 1 to 5 days after their initial course because of pain, swelling, or lesion enlargement. The author concluded that HVDC therapy appears to be an effective first aid measure or supplement to conventional therapy for all kinds of venomous bites and stings.[9]

The second article provided summary statistics and a few case summaries from 147 patients treated with HVDC therapy between September 1988 and January 1991. Included in this number were the 21 patients previously described[9] and 126 additional patients treated between October 1989 and January 1991. During this 16-month period, the author treated, on average, 7.9 patients each month with HVDC therapy. The majority (87%) of spider bites treated were diagnosed on the basis of lesion appearance alone. Spiders were visually identified as the bite source in 13% of treated patients, with brown recluse spiders found in the area at the time of the bite in 10.9% of patients. Patients ranged in age from 15 months to 89 years, with 12 patients ≤10 years and 13 patients ≥66 years of age being treated. Several patients were treated for multiple bites at the same time, and 5 patients were treated for bites more than once at different times. The time to HVDC treatment ranged from 2 hours to 5 weeks after lesion appearance. HVDC treatment was initiated within 2 days in 58.5%, 2–5 days in 29.9%, 6–14 days in 6.8% and >14 days in 4.8% of patients. The author stated, ''As long as there is any evidence of venom activity, such as pain, fever or inflammation, HVDC therapy may be beneficial.'' Patients reportedly experienced relief of local pain and swelling, systemic pain, nausea, and shortness of breath within 15 minutes of receiving HVDC therapy. The author again reported that no patient experienced progression of venom-induced tissue damage after the initial course of HVDC therapy. However, repeat HVDC therapy was provided to a number of patients for residual itching and discomfort. Transient local discomfort was the only adverse effect reported by the author. The author concluded that HVDC therapy should be used in all cases of confirmed or suspected venomous spider bites and that specific identification of a vector is not necessary to achieve good results.[10]

The third article consists primarily of case reports detailing the use of HVDC therapy for 1 wasp sting and 5 snakebites. In the introduction of this article, the author states that they have successfully treated a total of 304 spider bites with HVDC therapy. Included in the 304 cases were the 147 cases previously described[10] and 157 additional patients between February 1991 and June 1992. During this 17-month period, the author treated, on average, 9.2 spider bite patients each month with HVDC therapy. J & K Industries, a stun gun manufacturer, and *Outdoor Life* magazine were credited with providing the information necessary to develop the HVDC therapy protocol. The author recommended that HVDC therapy be initiated as soon as possible to avoid anaphylaxis, limit tissue damage, and reduce pain. This has reportedly reduced the need for some routine procedures. Again, the author states that identification of the vector is unnecessary because all venoms encountered to date have responded favorably to HVDC therapy. The author concluded that patient age, underlying medical conditions, or both are not contraindications and that HVDC therapy should become a routine first aid treatment.[11]

The fourth publication was a letter to the editor refuting the potential dangers of HVDC therapy. Osborn stated that he has used HVDC therapy 498 times, on patients as young as 5 months of age and as old as 93 years of age, without a single complication. He went on to state that his HVDC-therapy protocol is safe because it utilizes multiple 1–2-second discharges, whereas a

continuous 3–5-second discharge is required to disable a person with a 50-kV stun gun.[12]

Barrett et al[13] examined the effects of HVDC and dapsone therapy on simulated brown recluse spider bites in Hartley guinea pigs. The study was performed prospectively and in placebo-controlled fashion. Spider venom was obtained from a commercial source, and by use of a dose-ranging study, the authors found that a 30-μg dose induced a lesion characteristic of necrotic arachnidism. Primary study outcome measures were the size (expressed as area [mm^2]) of erythema, induration, blistering, and necrosis within the lesions. Lesion measurements were performed 16, 24, 48, and 72 hours after venom injection. The initial (16 hour) measurements were used as a baseline to calculate percentage of change in lesion size on the second and third study days. Guinea pigs received a single intradermal venom injection in a shaved area on their dorsum and were randomized into 1 of 4 treatment groups. The first group (4 animals) received dapsone 0.7 mg/kg twice daily for 3 days. The second group (4 animals), while anesthetized, received four 1-second shocks in a clockwise pattern around the lesion from a Parali/azer stun gun (Southwest Shooters' Supply, Oklahoma City, OK) equipped with extension wires. The third group (5 animals), while anesthetized, received four 1-second shocks in a clockwise pattern around the lesion from a Guardian stun gun (Life Products, Las Vegas, NV) equipped with an extension wire. The fourth group (6 animals) received no treatment. Treatment was initiated 16 hours after venom injection in groups 1, 2, and 3. The authors felt that a ≥100% increase in lesion area over the 72-hour study period would be clinically significant. Use of the Parali/azer stun gun delayed wound healing and resulted in significantly ($P \leq .05$) larger (values not given) areas of induration when compared to untreated animals. Use of the Guardian stun gun was not associated with any significant lesion area alterations at any time period. Dapsone treatment was associated with significant ($P \leq .05$) reductions in the area of lesion induration at 72 hours compared to control and Guardian stun gun–treated animals (≈25 vs ≈60 and ≈65 mm^2, respectively). At 72 hours, the area of lesion necrosis was also significantly ($P \leq .05$) reduced in the dapsone versus control and Guardian stun gun–treated animals (≈3 vs ≈9 and ≈13 mm^2, respectively). The area of lesion necrosis was significantly smaller ($P \leq .05$) at 48 hours (≈4 mm^2) and 72 hours (≈3 mm^2) than at 24 hours (≈16 mm^2) in the dapsone group but not in any other treatment group. The authors thought that the large variability between the Guardian and Parali/azer stun guns may have been secondary to differences in arc duration. The authors pointed out that with sufficient time all simulated spider bites healed.[13]

Other arthropod bites or stings

Using the spark plug wire of an internal combustion engine to treat scorpion stings is a folk remedy that dates back to at least the 1940s.[14,15] This practice has not been proven effective and may be dangerous.[14] An unreferenced article in the magazine *Sierra* off-handedly stated that HVDC therapy effectively treats ant and sea scorpion bites.[16] Guderian et al, in a letter to the editor, reported that HVDC therapy has been successfully used to treat ant (*Paraponera* spp) bites and black scorpion (*Tityus* spp) stings in the jungles of Ecuador.[17] Osborn[9] reported that HVDC therapy immediately relieved the local symptoms associated with bee, bumble bee, and red wasp stings. In a subsequent article,[11] Osborn reported that he had successfully used HVDC therapy to treat 42 stings. These patients attributed their stings or bites to 25 unknown agents, 9 wasps, 3 bumblebees, 2 scorpions, 2 yellow jackets and 1 tick. HVDC therapy reportedly relieved pain and itching in 10 to 15 seconds, with reductions in local reactions and systemic symptoms (neither defined) apparent within 15 minutes. No specific information was presented detailing why these 42 stings or bites required treatment as aggressive as HVDC therapy. Osborn also described the clinical course of a 12-year-old boy treated with HVDC therapy for a red wasp sting on the bridge of the nose. The patient presented to the emergency department 3 hours after the sting with facial swelling and slight dyspnea. The patient had taken 50 mg of diphenhydramine orally at home and received epinephrine and methylprednisolone 80 mg intramuscularly on arriving at the hospital. Approximately 15 minutes later, HVDC therapy (3 shocks) was initiated, with the patient reporting an immediate relief of discomfort. The patient was discharged from the emergency department approximately 25 minutes later with reduced facial swelling and without dyspnea.[11]

Snakebites

In 1999, sixty-four poison control centers fielded 5767 calls concerning snakebites. The most common sources of snakebites were nonpoisonous snakes (37.7%), unidentified snakes (30.9%), rattlesnakes (17.2%), copperheads (10%), and cottonmouths (1.9%). Two snake bite–associated deaths were reported in 1999.[5] Five genera of poisonous snakes are indigenous to the United States.[18] In 1999, the 3 genera encompassing rattlesnakes, copperheads, and cottonmouths were responsible for 93% of all reported venomous snake bites to humans in the

United States.[5] The remaining 2 genera of poisonous snakes are coral snakes (family Elapidae).[18] In 1999, coral snakes accounted for 2.5% of all reported venomous snake bites to humans in the United States.[5]

The use of HVDC shock therapy has been touted[17,19,20] and also repudiated [18,21–27] as a safe and effective treatment modality for venomous snakebites. In 1986, Guderian et al reported that they had treated 34 snakebitten Waoroni Indians in Ecuador with HVDC shock therapy.[17] The shock treatments were administered by using a stun gun that delivered 20–25 kV of less than 1 mA of direct current to the bite site. Initially, 1 fixed probe of the stun gun was used as the ground while the other fixed probe was utilized to apply the shock. Guderian later modified his HVDC shock technique by attaching an extension wire to one of the stun gun's fixed probes. The addition of an extension wire allowed the HVDC shocks to be administered through or across the entire affected area. Typically, 4 or 5 HVDC shocks were administered with a 5 to 10 second rest between shocks. Only 2 of 34 bites detailed in this report were positively identified as coming from pitvipers (*Bothrops atrox* [fer-de-lance] and *Lachesis muta* [bushmaster]). The author reported that both of the patients with documented pitviper bites recovered after administration of 7 HVDC treatments. Seven patients reportedly refused HVDC shock therapy. All 7 experienced complications as a result of their snakebites and 2 required life-saving amputations. The authors hypothesized that the beneficial effects of HVDC therapy may be the result of direct effects on the venom or that the therapy prevents the vascular spread of the venom.[17] Theakston et al later determined that 78% of Waoroni Indians tested positive for snake antibodies that might afford at least some degree of immunity to snakebites.[28]

Harding interviewed Guderian approximately 3 years after the initial publication of his letter to the editor detailing the use of HVDC therapy in Ecuador. At this time, Guderian had treated ≈300 snakebite victims with HVDC. In approximately 100 of these cases, a venomous snake was identified and medical follow-up was adequate for evaluation. Almost all (96) patients treated within half an hour exhibited no envenomation effects. Guderian reported that he had quit using stun guns and now utilized the ignition system of small motors to deliver HVDC therapy. Guderian stated that he still considers HVDC experimental and would like to see further clinical trials.[29]

Mueller, in the first of 2 articles published in 1988 in *Outdoor Life* magazine, related several anecdotal stories of both people and animals being treated with HVDC shock therapy for snakebites. The first case described was of a veterinarian's successful use of a pickup truck ignition system and 2 pieces of insulated wire to treat a dog bitten by a rattlesnake. The second case described a Missouri physician's use of his car and a set of jumper cables as a means of delivering HVDC shocks to a woman bitten by a copperhead snake. According to the article, the physician thought that the high-voltage shock would upset the electrical properties of the metal ions found in snake venom, ''possibly uncoupling what makes the venom work.'' Mueller goes on to report that Dr Guderian has received numerous reports about the successful use of HVDC shock therapy for treating venomous snakebites from several countries, including Japan, Peru, Columbia, Argentina, New Guinea, and Africa.[19]

In the second article, Mueller describes other conditions that reportedly were successfully treated with HVDC shock therapy, including stingray stings, scorpion stings, fire-ant stings, migraine headaches, boils, chronic back pain, and infections unresponsive to antibiotic therapy. On a conservative note, he suggests that treating the bite of a coral or cobra snake is not practical because of the speed at which these snakes' neurotoxic venom works.[20]

McPartland and Foster detailed their experiences of treating snakebites with a stun gun in a letter to the editor. One of the authors sustained 2 bites from a timber rattlesnake on the radial aspect of the left forearm. Three fang puncture sites were quickly identified and shocked 6 times (0.5–1 second per shock) each with a Nova-Spirit stun gun (40 kV) (J B K Industries, Claremore, OK). The fourth fang puncture site was found sometime later and was not treated with HVDC therapy. The untreated puncture site was the only involved area to develop a hemorrhagic ulcer. The untreated puncture site was located ≈2 cm from a HVDC treated puncture site that led the authors to postulate that the accuracy of shock placement is very important to the success of HVDC therapy. The authors suggest that HVDC therapy reduces complications and enhances healing of snakebites.[30]

Kroegel and Meyer zum Buschenfelde proposed 3 possible mechanisms for the success of HVDC shock therapy. First, the applied current may destroy secondary and tertiary structures of enzymes by changing hydrogen bonds. Second, the electrical current may reduce some metal ions that may serve as mandatory cofactors for enzymes in the venom. Third, the applied electrical current may have some yet unknown direct action on the venom itself.[31]

Numerous articles and letters have appeared repudiating the validity of using HVDC shock therapy for venomous snakebites. Russell considered that the use of electricity to treat snakebites was ''folk medicine'' and

that it may delay the use of proven lifesaving therapies.[21] Gold stated that the continued use of HVDC shock therapy for treatment of snakebites is another instance in which favorable results of anecdotal reports have not been reproduced in controlled studies.[23] Bucknall, in a lengthy letter to the editor, summarized the data on the use of HVDC shock therapy for venomous bites and stings and systematically repudiated each claim and theory.[22] In 1992, Hardy published an insightful and thorough review of the literature describing the use of HVDC therapy for venomous snakebites. Hardy, in addition to summarizing the literature, was also able to include numerous pertinent personal communications from involved individuals and briefly describe the results of 2 unpublished animal studies that found no benefit from HVDC therapy. Ultimately, Hardy determined that the data currently available did not support the use of HVDC therapy for venomous snakebites.[29]

In one of the few laboratory studies available, Johnson et al evaluated the effects of HVDC shock therapy on mice injected with snake venom. Mice were injected with reconstituted rattlesnake venom (*Crotalus viridis oreganus*) at various LD_{50} multiples. Some mice received HVDC shock therapy from a car electrical coil powered by a 12-V battery producing a 20–25-kV current. All mice injected with either 3.0 mg/kg or 6.0 mg/kg of venom died in both HVDC and control groups. Approximately 87% of mice died in both groups after venom doses of 1.75 mg/kg, whereas all mice survived venom doses of 1.5 mg/kg. The authors concluded that HVDC therapy was ineffective in reducing the lethal effects of snake venom in their study and speculated that mice may not be the best animals to use for this type of study.[25]

In an interesting experiment, Dart et al attempted to simulate the conditions present in the Ecuadorian jungle. During the preliminary phase of the experiment, mice were injected with Western diamondback rattlesnake (*Crotalus atrox*) venom and then shocked using a spark plug wire from a 1956 Ford truck. Results from the preliminary phase of the experiment were inconsistent. However, the fact that some groups of shocked animals appeared to respond to the therapy prompted the authors to conduct a second, better controlled study. During the second experiment, 40 Sprague-Dawley rats were injected with 80 mg/kg of *C atrox* venom. The HVDC treatment group immediately received ten 1.8-second shocks (25 Hz, 25 kV, and 1 mA) from a modified automotive ignition system, whereas controls received no treatment. No benefit of HVDC therapy was identified in this study and mortality was similar in both treated and untreated rats at 12 and 24 hours.[32]

Howe and Meisenheimer found that the use of HVDC shock therapy failed to reduce either morbidity or mortality in rats injected with diluted commercially available venom of the Ecuadorian fer-de-lance snake (*B atrox*).[33] Stoud et al reported that four 2-second shocks (1800 V, 8.19 A) did not improve outcomes after rabbits were injected with 1 mg/kg of Eastern diamondback rattlesnake venom (*Crotalus adamanteus*).[34] Snyder et al studied the effects of HVDC therapy on simulated Western diamondback rattlesnake (*C atrox)* and cottonmouth (*Agkistrodon piscovorus leukostoma*) envenomation in dogs.[35] Dogs in the HVDC group received five 1–3-second shocks as previously described by Guderian.[17] No differences were evident to the investigators during their 36-hour comparison of HVDC-shocked and control dogs.[35]

Davis et al treated isolated rattlesnake venom with HVDC shocks to determine if high voltage had any effect on the lethality of the venom. The isolated venom was shocked for 18 times longer than recommended by the stun gun manufactures advertising their devices as snakebite treatments. Subsequent LD_{50} determinations carried out in mice found no significant difference between the HVDC-shocked and nonshocked venom.[24]

Dart and Gustafson described in detail the case of a 28-year-old man who was bitten near his right upper lip by his pet Great Basin rattlesnake (*Crotalus viridis lutosus*). The patient had been previously bitten 14 times. During treatment for 1 of these 14 bites, the patient had experienced an anaphylactic reaction to antivenom. On the basis of information they had read in an outdoorsman's magazine, the patient and his neighbor developed a plan to use HVDC shock treatment in case the patient was bitten again. The patient and his neighbor were provided with the opportunity to test their plan after the patient's 15th rattlesnake bite. The snakebitten patient was placed on the ground close to the car. The HVDC shock was delivered by attaching a lead wire from one of the car's spark plug wires to the patient's lip. The neighbor then started the car and revved the engine to 3000 revolutions per minute repeatedly for approximately 5 minutes. The patient reportedly lost consciousness during the first HVDC shock treatment. The ambulance crew, who arrived about 15 minutes later, found that the patient was unconscious and had fecal incontinence. On the basis of the ambulance crew's initial evaluation of the patient's unstable vital signs, he was transported to a hospital by helicopter. The patient arrived at the hospital approximately 1 hour and 40 minutes after the bite. In the emergency department, the patient was found to be obtunded, hypotensive (blood pressure 62/palpable mm Hg), tachycardic (pulse rate 120 beats/min) and hypothermic (35.4°C). The patient experienced severe face and neck swelling that necessitated nasotracheal intu-

bation. After fluid resuscitation therapy, the patient regained consciousness and vital signs stabilized. Laboratory testing revealed moderate coagulopathy (protime ≈20 seconds) and thrombocytopenia (<40 000 mm^3) that resulted in the administration of 10 units of platelets. The patient exhibited a positive skin test reaction to *Crotalidae* polyvalent antivenom and received hydrocortisone 200 mg, diphenhydramine 100 mg, and cefazolin 1 gm intravenously as antivenom pretreatment. During the following 8 hours, the patient received 27 vials of antivenom. The patient was discharged after a bout of serum sickness with residual facial edema and loss of facial tissue, which ultimately required surgery.[35]

All of the studies available to date have their limitations. One major recurring concern of HVDC therapy advocates is that no human subjects were used, only laboratory animals. HVDC supporters question whether using an animal (mice and rats) that venomous snakes normally prey on is appropriate. In a letter to the editor, Blaylock[27] stated that ''rats are not human, but it is unlikely that electrotherapy will be found more beneficial than placebo in the management of snakebite.'' Other recurring concerns involve the type (fresh vs commercially available), source (species), and dose of venom administered in the controlled trials.

Safety

Stun gun shocks may produce symmetrical circular areas of superficial hypopigmentation or burns. Up to 4 (2 from the primary contacts and, less commonly, 2 from the voltage-limiting spark-gap pins) of these lesions may develop at each site where the stun gun delivered a shock. Fresh HVDC lesions may also be raised and erythematous.[1,2] Robinson et al studied the performance of 6 stun guns at a resistance load of 500–5000 Ω and found that peak voltage ranged from 1.9 to 27.4 kV, peak current from 2.9 to 8.1 A, and pulse duration between 4.5 and 41.6 microseconds.[3] Deaths have occurred 5 to 25 minutes after HVDC shocks delivered by a Taser electronic gun (barbed projectiles deliver the shock) in phencyclidine intoxicated patients.[37]

Roy and Podgorski[2] studied the effects of 2 stun guns, 1 high output and 1 low output, on the cardiac conduction of 2 anesthetized Yorkshire pigs. Studies were conducted with the stun guns placed externally on the chest wall, on the exposed pericardium, and on the chest wall of a pig with an implanted cardiac pacemaker. When placed on the intact chest wall, both guns produced superficial burns, but only the high output device altered cardiac rhythm. The high output gun was able to induce asystole for as long as it remained on when firing through 3 layers of operating room towels placed on the chest wall. Cardiac rhythm returned to normal if the device was shut off in ≤30 seconds. If the device remained activated for >30 seconds the animal developed ventricular fibrillation with resultant pump failure. Direct pericardial shocks resulted in arrhythmias after shocks from the low output gun and ventricular fibrillation after shocks from the high output gun. The internal leads of the implantable cardiac pacemaker efficiently carried impulses from external chest wall shocks resulting in ventricular fibrillation.

Gushee and Dedolph[38] describe the successful use of stun guns to resuscitate a patient. The 39-year-old patient had no pulse and was not breathing when found by police officers. The patient had attempted suicide by ingesting sleeping pills, followed by hanging. The officers performed cardiopulmonary resuscitation, which led to return of both pulse and respirations. After several minutes of spontaneous respiration and palpable pulse, the patient became apneic and pulseless. The officers administered HVDC shocks by discharging 2 NOVA stun guns placed on the patient's chest. This resulted in return of both a palpable pulse and spontaneous respiration. The officers successfully repeated this procedure 5 more times for reoccurring episodes of pulselessness and apnea prior to the arrival of paramedics. Unfortunately, no cardiac monitoring devices were available during these episodes. Thus, we cannot be sure that the HVDC shocks altered a potentially fatal dysrhythmia or simply caused significant pain that stimulated the patient's cardiac and respiratory activity.

Global statements concerning the safety of stun gun devices cannot be confidently made because the devices have been insufficiently tested, exhibit considerable intragun and intergun variability, and tend to malfunction frequently.[3,39] The potential fibrillatory risk associated with prolonged stun gun shocks has not been well studied.[2,3] HVDC shock therapy is likely most dangerous in the very young, the elderly, phencyclidine intoxicated patients, and patients with preexisting cardiac disorders or pacemakers.[2,37–39]

Using the ignition system of an internal combustion engine may have contributed to the death of at least 1 patient and the disfigurement of another.[21,36] Significant tissue damage has been reported in patients who were mistakenly shocked with a lead from a high amperage ignition system.[21,22]

Summary

There is a large amount of data available detailing the potential beneficial effects of HVDC therapy in the form of personal testimonials, anecdotal reports, and uncontrolled case reports involving both humans and animals.

In contrast, the results of controlled trials utilizing snake or spider venom injected into mice, rats, rabbits, and dogs have found HVDC therapy does not positively effect the natural course of envenomation and, in some cases, may delay wound healing. Administration of HVDC shocks is reportedly well tolerated by patients and appears to carry little intrinsic risk in otherwise normal, healthy patients. One major concern about the use of HVDC shock therapy is that patients may believe that they have been treated adequately and thus may not promptly seek appropriate medical care after a clinically significant bite or sting. HVDC shock therapy is not supported by the scientific literature and should not be considered a viable treatment option for venomous bites or stings.

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