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Between September 1988 and September 1989, 21 cases of confirmed or suspected spider bite were treated with high voltage direct current electric shock. In every case, tissue damage was arrested with the first treatment, and none of the cases required excision or graft.

As a result of information from articles in *Outdoor Life*¹ reporting results obtained by Ronald Guderian, MD,² a hand-held electronic device (Stun Gun), which delivers 45 to 50 kV at 4.5 mA of direct current from a small 9-volt alkaline battery, was obtained for emergency first aid use in the event of a venomous bite or sting. Units of this type are carried by many police officers to control difficult subjects and by other people for personal protection.

Method

According to Dr Guderian² and Cliff Mackey,³ at least 20 to 25 kV at 1mA is needed for treatment. Multiple shocks of 1 to 2 seconds were used (two or more depending on the extent of the lesion). An extension wire (made from disposable Bovi ground wire) allowed grounding on the opposite side of a limb or across the area of reaction so that shock could be delivered through the depths of the bite and/or across the area of damage.

Alternating current (AC, or house) is absolutely contraindicated.

Since most venoms contain enzymes that promote dispersion of the venom, direct injection into the bite site allows spread through each needle track and should not be done.

A series of 24 cases of venomous bites occurring between September 1988 and September 1989 and treated by high-voltage DC shock is reported. No case progressed to increased tissue damage after first treatment. No case required excision or graft.

Report of Cases

Case 1. A 10-year-old white female awoke with pain in her left deltoid; a brown recluse spider (*Loxosceles reclusa*), also known as a fiddleback spider because of the distinctive violin-shaped marking on its back, was found in her bed. When she came in for treatment (probably within 4 or 5 hours of injury), she had an indurated area 4 to 5 cm in diameter that was very painful to pressure; there was no discoloration. Using the Stun Gun, high voltage (45,000-50,000 V) direct current shock was administered twice through the center of the area, grounded on the opposite side of the arm. Induration began to subside within 45 minutes and pain decreased. The following morning induration had subsided to approximately 1 cm and 24 hours later had essentially disappeared. No discoloration or tissue damage occurred.

Case 2. A 51-year-old white female was treated in the emergency room for a brown recluse spider bite on her chest and right axilla. She was given injections of dexamethasone sodium phosphate and

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diphenhydramine hydrochloride and started on cephalexin. Six days later she heard about Case 1 and requested treatment by the same method. A reddish purple area 7×9 cm was found on the upper anterior right chest, with an extension on the inner, upper edge of the right breast. There was an additional 1×3 cm area in the anterior right axilla with longitudinal central blanching and whitened skin. It was explained to the patient that a large slough which might ultimately require skin graft was possible, or probable. High-voltage direct current shocks were administered to both areas (number of shocks not noted, but more than one to each area). Intravenous calcium gluconate, 2 gm, was administered in divided doses to relieve tight chest muscles unrelated to the electric shock.

Five days later, the axillary lesion was smaller, with normal skin coloration. The anterior chest wall lesion measured 5×7 cm, with damage appearing to be more superficial. The area was shocked twice in a cross pattern. Nine days after the second shock treatment, the area measured 3×6 cm. The patient again had chest tightness, which was relieved by intravenous calcium gluconate, 2 gm, administered in divided doses.

One month later the patient had an area of thick dead skin 2×2 cm and chest wall tenderness, again relieved by intravenous calcium gluconate, 1.0 gm. A picture, taken ten weeks after the bite occurred and furnished by the patient three weeks after her last treatment, showed a scar of 2 cm or less. No graft was required.

Case 3. A 22-year-old white female presented with a bite on her right calf and anterior right thigh that had occurred two days prior to examination (diagnosis again on basis of appearance of lesion). One day after the bite occurred, her physician injected cortisone and began treatment with antibiotics. The second day after injury she met Patient 2. She subsequently requested treatment.

A reddened right calf lesion 11×12 cm with some darkening of the central area was found, with a red streak 2.5 to 3.0 cm wide extending to or above mid-thigh (medial aspect) (Fig 1A). The right calf measured 35 cm, the left 33 cm. A separate red lesion 3×3.5 cm was on the anterior thigh at the junction of the middle and lower third (Fig 2A). The right inguinal nodes were slightly tender. High-voltage direct current shock was administered twice through the central area of the right calf lesion, with grounding on the opposite side of the calf; two shocks were then administered each way across the lesion in a

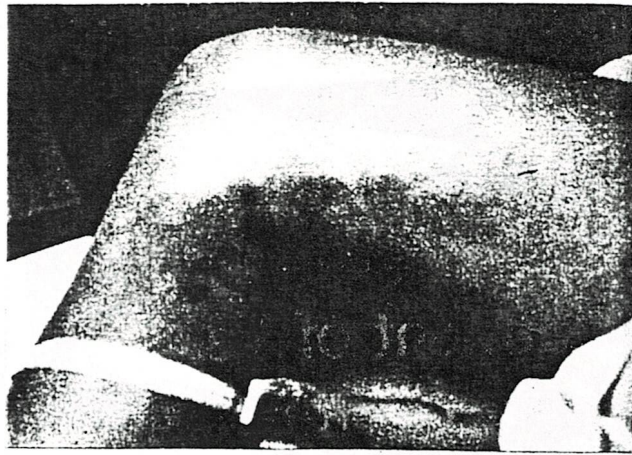


Figure 1A. Case 3 — Patient presented with reddened right calf lesion measuring 11×12 cm.

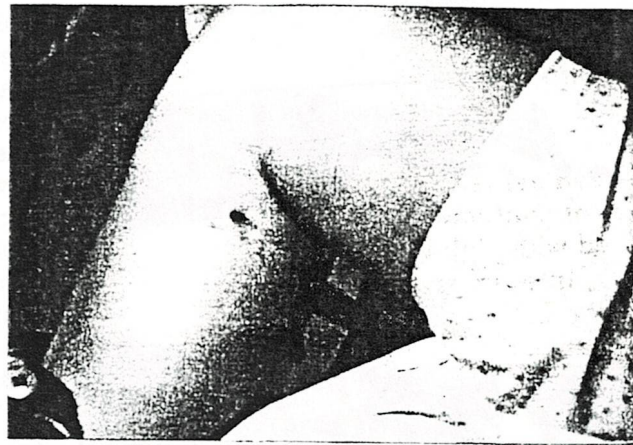


Figure 1B. Right calf lesion, twelve days after treatment.

cross pattern. The anterior thigh lesion also was shocked twice each way in a cross pattern. The patient was given a tetanus toxoid booster and advised to continue her antibiotics. The following day the patient reported by telephone that all pain and swelling were gone and redness was subsiding. When examined five days later, the calf lesion was 2×2 cm and very superficial with dark spots that represented cortisone injection sites. The anterior thigh lesion was less than 0.5 cm with no redness (Fig 2B). No streak or inguinal node tenderness was present. The right calf measured 33 cm, the left 33 cm. (The patient again reported that all pain and swelling was gone the morning after treatment.)

Case 4. One day after sustaining a bite on his right thigh, this 20-year-old white male was treated elsewhere, probably with a cortisone injection. When examined two days after the bite occurred, the lesion measured 15×15 cm, with a dark center (Fig 3A). The lesion was shocked twice through the bite, with

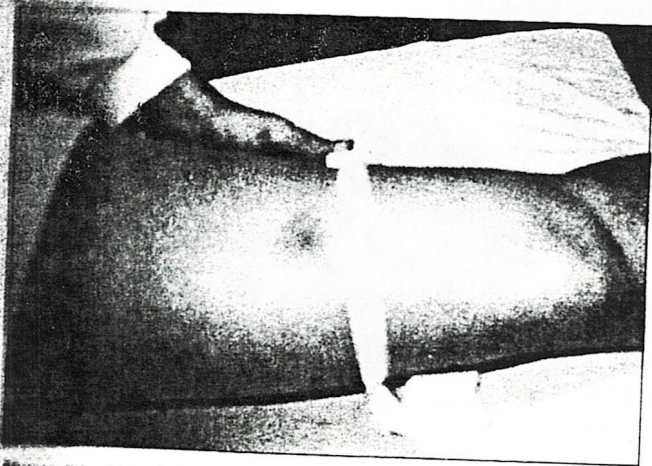


Figure 2A. Case 3 — Patient had a separate red lesion, measuring 1.3 x 1.3 cm, on anterior right thigh.

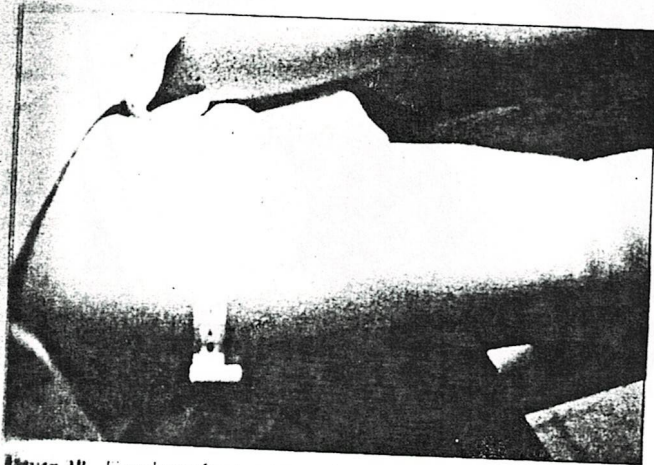


Figure 2B. Five days after treatment, lesion measured less than 0.5 cm, with no redness.

ground on the opposite side of the leg, then cross shocked twice each way. The right thigh measured 40.6 cm at 22"; the left measured 48 cm at 22". There was immediate relief of pain.

Two days later, the patient reported there had been no pain since treatment. There was some purpura, and the lesion measured 23 x 20 cm (Fig 3B). The right thigh measured 48 cm at 22" and the left 48 cm at 22". Shock was repeated as before.

On examination four days later, minimal purpura with a 3 x 2 cm area of mild induration and a small central crust was noted (Fig 3C).

Case 5. This 47-year-old male awoke with cough, wheeze, and shortness of breath at 2 AM. A bite was found under the left arm and a brown recluse spider was found in the bed. The patient was treated by his physician with cortisone injections and was given prescriptions for cortisone and antibiotics. When examined three days after the bite occurred, the patient had pain, swelling, and induration under the

left arm which measured 8 x 14 cm with 1 x 1 cm central discoloration. High voltage shock was administered twice through the center of the lesion, followed by cross shocks twice each way. The patient reported immediate relief (less than 10 minutes) of the left arm and shoulder pain.

Five days later the patient reported he had had no pain since his last office visit. There was induration 2 cm in diameter with a 1 cm central red area with crust in the center.

Case 6. A 34-year-old white female presented with a history of bite (presumed to be a spider) on the right leg three days prior to examination. One day after the incident she developed marked ivy dermatitis which involved several areas (including the bite area) weeping serum. There was a 1.2 x 1.4 cm raw weeping area on the anterior surface of the right leg, 13 cm above the medial malleolus. The right leg measured 30 cm and the left 27 cm at this level. High voltage shock was administered twice through the center of the lesion, with ground opposite on the leg. Shock across the lesion was administered two times each way. Methylprednisolone acetate suspension, 120 mg, was administered intramuscularly and methylprednisolone tablets (Medrol Dospak) were prescribed. (The patient reported the dermatitis began drying the next day.)

Three days after treatment, the left leg measured 27 cm at 13 cm, and the right leg 28 cm at 13 cm. The patient still had some ivy blisters but was much improved. The dark area (bite) was dry and measured 0.6 x 0.7 cm.

Case 7. Spider bite was diagnosed in a 25-year-old white male. The patient was treated in the emergency room with cortisone injection into the bite. Injury had occurred 24 to 48 hours prior to treatment.

Examination revealed a discolored 3 x 3 cm reddened area, 15 x 15 cm back of the left thigh just above the popliteal space. Shock was administered twice through the bite area, and cross shocks twice each way.

Three days later, the dark area measured 5 x 5 cm and the red area 16 x 18 cm. The lesion was shocked as before. Examination thirteen days later revealed infection since the last visit. The patient was treated with cephalexin and cortisone. There was no pain in the 4 x 4 cm red area. Eight days later the red area measured 4 x 4 cm, with 1 x 2 cm dark area. After another eleven days, the crusted area measured 1 x 1.5 cm and the darker area 5 x 3.5 cm. The patient was dismissed.

Case 8. A 43-year-old white female presented with a bite on the inner right thigh, first noticed 24 hours prior to examination, and now more typical in appearance. She was referred by her physician. A red area 6.5×5.5 cm, with punctures in the center, was noted. The right thigh measured 53 cm, left thigh 52 cm. The bite area was shocked through the center twice with ground on opposite side of leg, then cross shocked twice each way. Tetanus toxoid booster was given and methylprednisolone tablets prescribed. One week later the lesion was dry, 1×1 cm, with each thigh measuring 51 cm. The patient was dismissed.

Case 9. A 21-year-old white female presented with a bite on her left leg, anterior surface, 30 cm above medial malleolus. The bite had occurred four days prior to examination. Medication was started (cephradine and methylprednisolone tablets). The lesion measured 6×7 cm and was painful. The left calf measured 35 cm, the right 34 cm. The lesion was shocked twice through center, then cross shocked twice each way. After five days, the left calf measured 34 cm, the right 34 cm. The lesion measured 2×2 cm. The patient reported relief occurred within two hours of treatment.

Case 10. A 67-year-old white male presented with a bite received 9 to 10 hours prior to examination. The patient was seen in consultation at the hospital and was admitted with fever. He had a lesion on the right flank, with a 5 mm vesicle in the center of a 13.5×7.5 cm red tender area, diagnosed as spider bite. High voltage DC shock was administered twice through the center of the lesion, followed by cross shocks twice each way. The patient had some pain relief in 5 minutes. His temperature returned to normal within four hours after shock treatment, and he had a comfortable night. He was discharged the following day by the attending physician, with a small (less than 1 cm) crusted lesion.

Case 11. A 30-year-old white male presented with what he thought was a spider bite, first noticed 24 hours prior to examination. The lesion had begun itching 12 hours later, and a generalized rash was noted. The patient was given a prescription for prednisolone, 10 mg, #30, to take in decreasing doses over 12 days. An injection also was administered. The lesion, on the left axillary line, measured 15×6 cm with a dark area 5×2 cm. It was shocked through twice, then cross shocked twice each way.

Two days later the lesion was 12×5 cm, lighter in color, and more superficial; the dark area was 5×2 cm, more superficial, and lighter in color. The

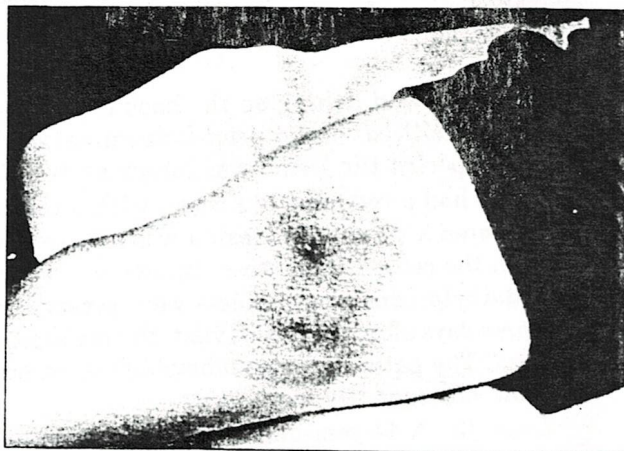


Figure 3A. Case 4 — On examination three days after bite occurred, site measured 15×15 cm, with a dark center.

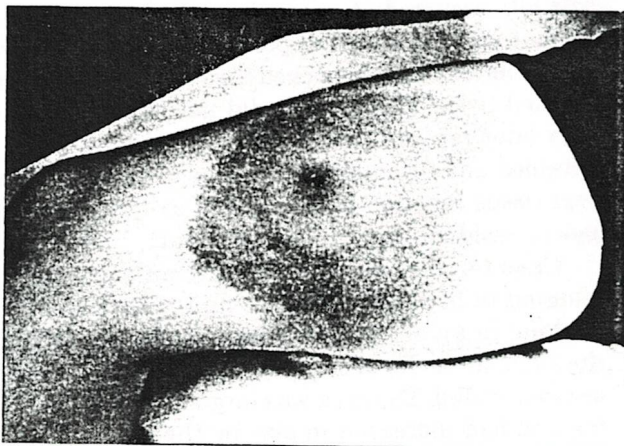


Figure 3B. Two days after treatment, lesion measured 23×20 cm, with some purpura.

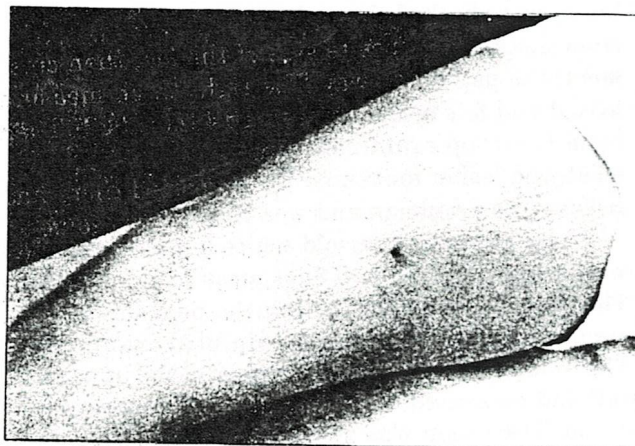


Figure 3C. Six days after treatment, lesion measured 3×2 cm, with mild induration and a small central crust.

lesion was shocked twice end to end, making the patient more comfortable.

Case 12. A 27-year-old white female presented

with a "bite" and itching on the back of her right thigh, first noticed one day prior to examination. The patient reported the lesion was larger at examination. She had a red area 12×6 cm, with a darker central area 2×3 cm. The lesion was shocked twice through the center, then cross shocked twice each way. Methylprednisolone tablets were prescribed.

Three days after the initial visit, the red area was 4×3 cm. The patient was comfortable (no soreness) and was subsequently dismissed.

Case 13. A 44-year-old white male presented with a brown recluse spider bite (vector unidentified by patient) at the junction of the right shoulder with the base of the neck. The lesion measured 3×5 cm. The bite occurred at approximately 2 AM and the patient was examined approximately nine hours later. The lesion was shocked through twice and cross shocked twice. The patient did not return but five days later reported by telephone that pain had subsided and disappeared the day of treatment and that tissue reaction had subsided so that no tissue loss or residual damage was present.

Case 14. A 47-year-old white female first noticed stinging in her right thigh at mid-afternoon while working in an old house. Stinging was repeated in the same area. No vector was seen. A red, itching area was noted. The area was larger the next morning and had increased in size by the time patient was examined, approximately 24 hours after the injury occurred. The area of redness and induration on the lateral mid-thigh measured 4×4 cm. The lesion was shocked through the center twice and cross shocked twice each way. Two days after treatment, the patient reported some "itching," but looked and felt better. The lesion was 2×2.5 cm. Upon follow-up examination five days after treatment, the lesion measured 2×2 cm. The patient reported no problems and was released.

Case 15. A 22-year-old white female presented with a bite received two days prior to examination. The wound had begun itching the next day and swelling that evening. It was painful at examination. The lesion was on the medial aspect of the upper left calf and measured 9×10 cm; the calf measured 44 cm. The lesion was shocked through twice, then cross shocked twice each way. Tetanus toxoid was administered and doxycycline, 100 mg twice a day, was prescribed. One day after treatment the patient was comfortable when still but had "burning" when up and walking. The calf measured 44 cm, with red area 12×14 cm. The lesion was shocked as before. Methylprednisolone tablets and warm packs were

prescribed. At an office visit three days later, patient reported no pain since last treatment. There was some itching and superficial slight redness. The lesion measured 7×12 cm, with the central lesion 0.5×0.5 cm. The patient was released.

Case 16. A 26-year-old white female presented with a bite that occurred on the right thigh, medial aspect, lower one-third area, 24 to 48 hours prior to examination. The lesion, 4×4 cm, was shocked twice, then cross shocked twice each way. Tetanus toxoid, 0.5 ccm, was administered and the patient was told to return in four days. Six days later, on the telephone, she reported "itching." She did not return for follow-up.

Case 17. A 28-year-old white female presented with a questionable spider bite injury received "one month ago." Examination revealed a red, tender lesion on the lower abdomen measuring 3.5×2.5 cm with a 1×1 cm central area. The lesion was shocked through the center and cross shocked twice each way. Five days later the patient reported having no soreness since the day after treatment. The lesion was 3×3 cm, with less redness, and the central area measured 0.5×0.7 cm. The patient was released.

Case 18. A 39-year-old white male presented with a lesion and some itching, which he had noticed on his back that morning. The lesion measured 5×5 cm, with central puncture marks but no pain. It had been diagnosed as spider bite by the referring physician. The lesion was shocked through twice and cross shocked twice each way. Four days later the patient was itching and had superficial redness, which measured 8×9 cm. The lesion was shocked twice each way. Methylprednisolone tablets were prescribed and tetanus toxoid, 0.5 ccm, was administered. One week after initial treatment, the lesion measured 7×9 cm. It was superficial, with less redness and no itching. The patient was released.

Case 19. A 12-year-old white female presented with a wolf spider bite (positive vector identification) on the palmar surface, proximal phalanx, of the left little finger. The patient was examined three hours after the bite occurred; she had pain and slight swelling. The area of swelling was shocked twice through the finger. The patient was more comfortable in 15 minutes. Forty-eight hours later, the patient was seen with nausea, vomiting, and bellyache. Hard, tight, painful recti were noted. Symptoms were relieved by intravenous calcium (2 gm in divided doses). The patient had no swelling of the hand.

Case 20. A 52-year-old white male presented with spider bite. (Spider was brought in; it was

neither a brown recluse nor a black widow (*Latrodectus mactans*). The patient had an itching, tender area on his left thigh, posteromedial surface at the junction of the middle and lower third. There was no visible damage. The area of the bite was shocked twice through the thigh. The patient was to check back regarding tetanus, but reported on the telephone three days later that he was completely asymptomatic.

Case 21. A 35-year-old white male presented with a bite on the back of his right arm, above the elbow, which was first noticed by his wife the day before. The patient complained of itching, with a tight feeling in his arm and hand. The bite area measured 5 × 4 cm. It was shocked through twice, then cross shocked twice each way. Methylprednisolone tablets were prescribed; the patient said he was "current on tetanus."

Two days after treatment, the lesion was 5 × 4 cm and superficial, with less discoloration. Discomfort (tightness) stopped within 6 to 8 hours after treatment and did not recur. The patient's last tetanus inoculation was six years earlier, so tetanus toxoid, 0.5 cc, was administered intramuscularly. The patient was dismissed.

In addition to these cases, three hymenopterous insect stings — one bee sting, one bumble bee sting, and one red wasp sting — responded to similar treatment with immediate relief of itching and reversal of tissue reaction.

Discussion

Loxosceles reclusa venom consists of at least 10 to 12 proteins, but no fraction has been isolated that produces the sequence of events that gives rise to the characteristic necrotic lesion. *Latrodectus mactans* venom consists chiefly of proteins, a few of which are enzymatic.⁴ The beneficial effects of high voltage direct current shock in the treatment of snake bite has been established.²

C. Koregel and K.H. Meyer-zum Buschenfelde, in a 1986 letter in *Lancet*,⁵ said, "We conclude that electrical current may directly modify the toxicity of animal venoms. Three different mechanisms seem to be responsible:

"(1) The current will influence the hydrogen bonds of the enzymes, destroying their secondary and tertiary structure.

"(2) The high voltage, low amperage current applied will reduce metal ions and zinc, copper, magnesium, iron, or calcium ions are firmly bound

to some venom enzymes and are mandatory cofactors for these enzymes.

"The electric particles interfere with the membrane as well as the positive charged polypeptides decreasing their cytotoxic properties."

As with any bite or injury, early treatment offers the best results (Case 1), but even late treatment (Cases 2 and 17) may be beneficial. Due to the habits of the brown recluse spider, most people are not aware of the bite at the time of occurrence.

Five of the bites (Cases 1, 5, 13, 19, and 20) had positive identification of a spider as the vector, with the remainder diagnosed on the appearance of the lesions. Most cases received cortisone, but the marked immediate pain relief cannot be attributed to cortisone alone.

Spider bites are a vexing clinical problem in primary care medicine, as they sometimes lead to skin necrosis and sloughing, and sometimes to an uncomfortable syndrome of chills, fever, and malaise. Envenomation is highly variable within and between species of spiders, and a prognosis on first examination is difficult. Many bites heal without morbidity or skin damage, and this complicates the evaluation of therapies aimed at preventing the skin necrosis and malaise sometimes resulting from spider bites.

In this series, no case showed any extension of tissue damage after shock was administered. Shock was repeated where there was any question of residual venom activity. The treatment quickly relieved pain in every case.

Conclusion

High voltage, low amperage direct current shock appears to be an effective, basically safe, mildly uncomfortable first aid emergency measure or supplement to conventional therapy for venomous bites and stings of all kinds.

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The Author

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