

## Pharmacology and Therapeutics

# Aluminum Chloride Hexahydrate Versus Palmar Hyperhidrosis

## Evaporimeter Assessment

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**ABSTRACT:** The efficacy of topical aluminium chloride hexahydrate 20% W/W ethanol (ACH) in the treatment symptomatic palmar hyperhidrosis was studied in 12 patients. A half-sided control single blind (assessor blind) study was done. Patients applied ACH on one palm daily for 4 weeks. The response to treatment was measured objectively with an evaporimeter. There was significant fall of skin water vapor loss (SVL) on treated palms compared with untreated palms. The basal mean SVL of treated palms and untreated palms were 79.9 and 77.9 g water/m<sup>2</sup>/h, respectively (n.s.). The mean SVLs of treated vs. untreated palms at week 1, 2, 3, and 4 were 66.4 vs. 79.7 (p < 0.05), 56.6 vs. 72.2 (p < 0.001), 58.2 vs. 72.5 (p = 0.1), and 51.4 vs. 72.7 (p < 0.001) g water/m<sup>2</sup>/h, respectively. The mean SVL of treated palms returned near basal rate within 1 week of stopping treatment. Four patients developed skin irritation from ACH; in three this disappeared after 1 week and they were able to continue with treatment; one withdrew from the study because of the severe irritation. All patients reported that the ACH reduced palmar sweating within 48 hours of application; its effect disappeared within 48 hours after stopping treatment. ACH appeared to be useful in rapid control of palmar hyperhidrosis.

The common nonsurgical modalities of treatment includes topical antiperspirants<sup>1</sup> and iontophoresis.<sup>2,3</sup> In this study we studied the efficacy of topical aluminium chloride hexahydrate (ACH) for treating palmar hyperhidrosis objectively with an evaporimeter.<sup>4-6</sup>

### Materials and Methods

Twelve patients with symptomatic idiopathic palmar hyperhidrosis were studied. Their age, sex, duration of hyper-

hidrosis, and previous modalities of treatment were recorded. Informed consent was obtained.

The rate of skin water vapor loss (SVL) (expressed as g water/m<sup>2</sup>/h) of the palms of the patients were measured with an evaporimeter (ServoMed, Vallingby, Sweden). A basal SVL was obtained on the first visit (day 0). Patients were then given a bottle of aluminium chloride hexahydrate 20% W/W in alcohol (ACH). Each patient was instructed to apply a thin layer of the solution on the same night and every night for 4 weeks (day 0–day 27) on one palm only; the patient selected the side himself. The treated side was blind to the author (assessor) until the end of the study. The opposite palm was left untreated (control). SVL measurements of the palms were done in the morning every week for 6 weeks. Patients were instructed to stop applying ACH immediately after SVL measurement on the 4th week (day 28), ie, there were four measurements during the treatment period and two measurements after stopping treatment. Side effects were recorded. Patients also were instructed to record any differences in palmar sweating between treated and untreated palm daily.

SVL was measured with an evaporimeter. The principle and methodology in the use of the evaporimeter has been described elsewhere.<sup>4,5</sup> SVL was expressed in gram of water/m<sup>2</sup>/h. All SVL measurements were done in the same room under same environmental conditions. The volunteer rested in the air-conditioned room for 5 minutes before measurement. The palms were then dapped dry with tissue paper. SVL of five areas on each palm viz, on the center of the palm, midthenar, midhypothenar, 2nd metacarpophalangeal joint, and 5th metacarpophalangeal joint were measured. A mean SVL for each palm was obtained by averaging the five values. The mean SVL of treated and untreated palms of each patient was recorded weekly over 6 weeks and compared.

The Student's paired t test was used in statistical analysis. Probability values <0.05 were considered statistically significant.

### Results

Twelve Chinese men (mean age, 23 years; range, 19–37 years) participated in the study. The mean duration of symptoms was 10.4 years (range, 1–20 years). Six patients had other modalities of treatment pre-

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viously; two with formalin soaks and iontophoresis (at different time), one with formalin soaks, and three with iontophoresis (as described by Abell<sup>3</sup>). Six patients treated their right palm with ACH.

The mean room temperature was 24C (range, 22.5-25) and relative humidity was 50.6% (range, 50-51) during the study period.

All patients reported that their treated palms were drier than untreated palms the following morning after starting treatment. All observed that palmar sweating returned to untreated state within 2 days after stopping treatment.

Four patients experienced stinging sensation immediately after applying ACH. In three patients the symptom disappeared after 1 week despite continuation of treatment. One patient dropped out of the study because he was unable to tolerate the side effect.

Table 1 compares the mean SVL between treated and untreated palms of the 11 patients who completed the study. The mean basal SVL for untreated and treated palms of the 11 volunteers were 77.9 g water/m<sup>2</sup>/h (range, 55.6-110.3) and 79.9 g/m<sup>2</sup>/h (range, 57-96.2), respectively (n.s.). The mean SVL of treated palms was significantly lower than that of untreated palms at weeks 1, 2, and 4. Although there was a difference in the mean SVL at week 3, the difference was not statistically significant. One patient had omitted applying ACH on the night before assessment at week 3. The mean SVL of treated palms returned to near basal rate at week 5.

Six patients who had other modalities of treatment previously preferred the new ACH treatment. All believed that ACH was convenient to use. Three patients who had iontophoresis treatment previously reported that iontophoresis was more effective than ACH. They also reported that iontophoresis appeared to have

more sustained effect than ACH (all reported effect lasting for about one week), but they remarked that ACH was a more convenient form of treatment. Two patients disliked iontophoresis because of its side effects; one experienced a severe sore throat/thirst and generalized warmth 6 hours after treatment and the other experienced intolerable pricking sensation of the palms during iontophoresis.

## Discussion

ACH has been used for more than a decade for the treatment of hyperhidrosis. It was reported to be an effective nonsurgical treatment of axillary hyperhidrosis.<sup>1,7</sup> Using the evaporimeter, a significant reduction in the mean SVL of the treated palms compared to untreated palms was demonstrated. The objective improvement observed was consistent with the subjective response observed by the patients. All patients reported immediate reduction in palmar sweating within 48 hours of application of ACH. The mean SVL of treated palms was consistently lower than the untreated palms during treatment.

The main disadvantage of ACH appeared to be its short duration of action. The mean SVL returned to untreated rate within 1 week of stopping application. All patients reported that their palmar sweating returned to untreated state within 48 hours of stopping ACH. The mechanism of action of ACH is not established. It is believed to act by occluding the sweat ducts by causing necrosis of the outer portion of the duct<sup>8</sup> and fibrillar contraction (without histologic changes) of the duct keratin.<sup>1</sup> The rapid response to treatment and rapid return of palmar sweating on stopping treatment does not appear to support the explanation of ductal occlusion because of progressive keratin changes. ACH appeared to exert some immediate direct effect on the sweat duct/gland to suppress palmar sweating.

The main side effect of ACH appeared to be skin irritation. Three of the four patients with initial irritation from ACH developed tolerance after 1 week. They were able to continue treatment. ACH is known skin irritant. Triethanolamine, however, was reported to neutralize the irritant effect of hydrochloric acid generated from ACH.<sup>9</sup>

## Drug Name

Aluminum chloride hexahydrate; Driclor, Drysol

## References

1. Shelley WB, Hurley HJ. Studies on topical antiperspirant control of axillary hyperhidrosis. *Acta Derm Venereol* (Stockh). 1975;55:241-260.

TABLE 1. Comparison of the Mean SVL Rates of Treated and Untreated Palms of 11 Volunteers Over 6 Weeks

Week	Mean SVL Rate (std Deviation) g/m <sup>2</sup> /h		p Values
	Untreated Palm	Treated Palm	
0	77.9 (15.0)	79.9 (11.5)	0.641
1	79.7 (14.8)	66.4 (24.7)	0.049
2	72.2 (23.6)	56.6 (18.8)	0.007
3	72.5 (21.2)	58.2 (19.4)	0.113
4	72.7 (17.0)	51.4 (16.5)	0.004
*5	77.3 (17.2)	70.5 (12.0)	0.065
*6	83.7 (13.4)	77.2 (22.7)	0.328

\* after stopping treatment

2. Bouman HD, Grunewald LEM. The treatment of hyperhidrosis of feet with constant current. *Am J Phys Med.* 1952;31:158-169.
3. Abell E, Morgan K. The treatment of idiopathic hyperhidrosis by glycopyrrolate bromide and tap water iontophoresis. *Br J Dermatol.* 1974;91:87-91.
4. Nilsson GE. Measurement of water exchange through the skin. *Med Biol Eng Comput.* 1977;15:209-218.
5. van Der Valk PGM, Nater JP, Bleumink E. Skin irritancy of surfactants as assessed by water vapour loss measurements. *J Invest Dermatol.* 1984;82:291-293.
6. Goh CL, Chia SE. Skin irritability to sodium lauryl sulphate as measured by skin water vapour loss by sex and race. *Clin Exper Dermatol.* 1988;13:16-19.
7. Brandrup F, Larsen FO. Axillary hyperhidrosis: local treatment with aluminium chloride hexahydrate 25% in absolute ethanol. *Acta Derm Venereol (Stockh).* 1978;58:461-465.
8. Reller HH, Luedders WL. Pharmacologic and toxicologic effects of topically applied agents on the eccrine sweat glands. In: Marzulli FN, Maibach HI, eds. *Dermatotoxicology and pharmacology.* Washington: Hemisphere Publishing 1977:1-54.
9. Flent-Madsen L, Dahl JC. Axillary hyperhidrosis: local treatment with aluminium chloride hexahydrate 25% in absolute ethanol with and without supplementary treatment with triethanolamine. *Acta Derm Venereol (Stockh).* 1968;68:87-89.



The case of Miss H. D. Epithelioma of the orbit, temporal, and molar region caused by radiation from an x-ray on May 20, 1910. Model by Dr. William Bainbridge. Photograph courtesy of Alan Hawk, Collection Manager, National Museum of Health and Medicine, Washington, D.C.

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