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## Axillary Hyperhidrosis. Local Treatment with Aluminium-chloride Hexahydrate 25 % in Absolute Ethanol with and without Supplementary Treatment with Triethanolamine

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In a randomized, double-blind, half-sided experiment, 30 volunteers were treated in both armpits with aluminium chloride hexahydrate 25% in ethanol. In order to neutralize pH and thus reduce the skin irritation, post-treatment was performed in one armpit with triethanolamine 50% in ethanol. The sweat production was measured after physical labour by means of a combined colorimetric/gravimetric method. The combined treatment with aluminium chloride hexahydrate and triethanolamine was found to be statistically significantly ( $p < 0.01$ ) less irritating to the skin, but also statistically significantly ( $p < 0.01$ ) less effective than treatment with aluminium chloride hexahydrate alone. However, the reduction in the effect of the treatment was not of a sufficient extent as to be noticed by the volunteers themselves. *Key words:* Antiperspirant; Sweating. (Received January 26, 1987.)

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The best medicinal treatment for axillary hyperhidrosis is aluminium-chloride hexahydrate (ACH) dissolved in ethanol (1-2). In a double-blind, controlled experiment, aluminium chloride 20% in ethanol was thus found to have a beneficial effect in 24 out of 38 patients whose sweat problems were so great that they were referred for plastic surgery (3). 19 patients found the topical treatment so satisfactory that they avoided the operation.

A frequent cause of discontinued treatment was unacceptable skin irritation, which has also been recorded by other authors (2). Furthermore, there has been a tendency towards decomposition of clothes near the armpits. For this reason, the American Food and Drug Administration has recommended that alcoholic solutions with aluminium chloride should only be dispensed on doctor's prescription (4). There is thus need to avoid or at least reduce skin irritation during treatment. Triethanolamine (TEA) is assumed to neutralize the hydrochloric acid developed on the surface of the skin without substantially affecting the aluminium chloride solution which has penetrated into the sweat glands.

The purpose of the test was to establish whether skin irritation following treatment with ACH 25% in ethanol is reduced by post-treatment with TEA 50% in ethanol, and whether the sweat-reducing effect is influenced by this combination treatment.

### MATERIALS AND METHODS

The test was carried out as a randomized and double-blind half-sided experiment. The volunteers were treated in the evening every 48 h during the course of 3 weeks. The persons had been instructed

that the skin should be absolutely dry prior to the application of each therapeutic agent. In one axilla, pure ethanol was first applied, followed by ACH 25% in ethanol. In the other axilla, ACH 25% in ethanol was first applied, followed by TEA 50% in ethanol. All therapeutic agents had been filled into containers with roll-on applicators. The sweat production of the axillae was checked before and after the 3-week treatment. Median values for the air temperature was 23°C for both checks and the median values for the relative air humidity were 73% and 75%, respectively.

After fixed work on a two-step ladder at 100 steps/min (2) for 10 min, the axillary sweat was collected on blotting paper treated with iodine (5). The area of the paper showing a colour change was excised and weighed. The persons stated their subjective opinion of the effect by indicating in one of 5 spaces ranging from 'no effect' to 'completely dry skin'. The duration of the effect of a single treatment was indicated by the volunteers as number of half-days (12 h). Any skin irritation was evaluated by a final check in 5 degrees of severity, and the volunteers indicated subjective adverse effects in 3 degrees of severity.

The volunteers consisted of 13 men and 17 women of an age between 19 and 50 years (median 28 years). Only 3 of the subjects complained of increased armpit sweating. None of the volunteers had been treated during the 2 weeks prior to the test. The axillary hairs were not removed either during the experiment, or within the last 24 h before the experiment.

In the statistical analysis, Spearman's test was used for the correlation analysis and Pratt's Rank Sum Test for paired data for the other analyses.

The test was carried out in accordance with the Helsinki Declaration II.

## RESULTS

By measuring the sweat secretion prior to the treatment, no difference in side was demonstrated ( $p > 0.05$ ). On the side treated with ACH followed by TEA, the median for sweat secretion dropped to 45% of the value before treatment (1st and 3rd quartiles were 23% and 70%, respectively). On the side treated with ACH alone, the median for sweat reduction decreased to 25% of the value before treatment (1st and 3rd quartiles were 7% and 37%, respectively). The difference between the decrease in sweat secretion during the two treatments was significant ( $p < 0.01$ ). On the other hand, the volunteers themselves could not distinguish with certainty between the effects of the treatments, either with respect to amount or duration of the sweat reduction ( $p > 0.05$ ). On the TEA-treated side, the median for the effect was 2.0 arbitrary units as opposed to 2.8 arbitrary units on the opposite side. The median for the duration of the sweat reduction after the individual treatments was 1.6 days on the TEA-treated side, and 2.0 on the side treated with ACH alone where the effect lasted until the next treatment. A statistically significant, positive correlation was found between the primary sweat secretion and the percentage of sweat reduction, irrespective of whether or not the treatment was supplemented by TEA ( $p < 0.001$ ; Spearman's test).

The treatment supplemented by TEA was felt to be less irritating to the skin than the treatment with ACH alone. The median values for subjective irritation were 0.3 arbitrary units and 1.2 arbitrary units, respectively. The difference was significant ( $p < 0.01$ ). Thus, after 1-5 (median 2) treatments, 6 persons (20%) discontinued treatment of the side not treated with TEA, because of irritation. At the end of the test, only slight objective changes caused by both treatments in the form of slight erythema were seen in four axillae.

## DISCUSSION

When the ACH treatment was combined with TEA, the sweat reduction dropped from 75% to 55%. This, however, is not considered to be of any important clinical relevance, partly because the decrease in the antiperspirant effect was not observed by the volunteers, partly because the effect increased with increasing primary sweat secretion. It must be asked the effect would have been greater if only volunteers with increased armpit

sweating had been used. Another reason is that it is possible, without any inconvenience, to compensate for the decrease in effect by using the combined treatment more often, as this was found to be significantly less irritating to the skin than treatment with ACH alone.

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