

AXILLARY HYPERHIDROSIS: LOCAL TREATMENT WITH ALUMINIUM CHLORIDE HEXAHYDRATE 25% IN ABSOLUTE ETHANOL

Flemming Brandrup and Poul Ølholm Larsen

Department of Dermatology, Odense University Hospital, Odense, Denmark

Abstract. Eleven women (group I) with axillary hyperhidrosis were treated ad modum Shelley & Hurley with local application of aluminium chloride hexahydrate 25% in absolute ethanol and plastic foil occlusion during two successive nights once a week. The patients were observed for 24 weeks. Another 12 women (group II) were treated for up to 12 weeks with aluminium chloride hexahydrate 25% in absolute ethanol but without using plastic foil occlusion.

We have attempted to determine the effect of the treatment by sweat measurements, leaving the left axilla untreated during the initial 1-2 weeks as a control.

An immediate reduction in sweat production of the treated axilla was found in both groups. The reduction increased during the first weeks and was maintained thereafter. The degree of sweat reduction was the same during standardized work and during rest (group II).

At the final controls all patients in group I had discontinued the occlusion and had individualized the treatment, most of them using local application 1-2 times weekly.

Two patients in group I had to stop the treatment because of unbearable itching. The other patients found the treatment completely satisfactory. All patients had experienced itching and smarting when starting the treatment. Often these discomforts were temporary but they seem to require active support by close medical control during the initial period of treatment.

In contrast to previous investigations, effective treatment was achieved both with and without occlusion.

Key words: Antiperspirant; Hyperhidrosis; Sweating; Aluminium Chloride

Axillary hyperhidrosis is a common condition which can subject sufferers to mental and physical strain, especially in the case of younger women. Since Stillian's (10) description in 1916, 20% aluminium chloride in an aqueous solution has been the generally employed local treatment. By and by many other metallic salts and locally applied anticholinergica have been used. However, the previously used local treatments were not sufficiently effective in the more severe cases. Consequently, attempts have been made to treat these patients

surgically with operations including radical or partial removal of the sweat glands (2, 3, 4, 5, 9) or even sympatectomia (11).

In 1963 Hurley & Shelley (3) described an operation consisting in excision of a limited area of the axilla where the largest number of sweat glands are to be found. This operation proved effective in a large series of patients (1). However, in a comment given by the authors (8) they reported having developed a topical treatment which seemed still more effective. This method consisted in local application of aluminium chloride hexahydrate 25% in absolute ethanol and plastic foil occlusion during two successive nights once a week. Using this method, local anhidrosis was achieved for one week. The results were judged by the lack of "shirt wetness" (7).

We have thoroughly tested the method in a group of patients during a long-term trial of up to 24 weeks and have tried to determine the results by sweat measurements (group I). Furthermore, the effect of the treatment without using plastic foil occlusion has also been investigated (group II).

MATERIAL AND METHODS

Aluminium chloride hexahydrate 25% in absolute ethanol was prepared at the Central Dispensary of the Odense University Hospital by dissolving aluminium chloride hexahydrate crystals in absolute ethanol, which takes about 4 weeks at indoor temperature. A limpid, strongly acid, viscous liquid was produced. The liquid was poured into glass vials fitted with a roll-on applicator.

Patient material. Group I: 11 women 20-38 years old ($\bar{x}=30$). Group II: 12 women 17-53 years old ($\bar{x}=32$).

All patients had previously tried treatment with aqueous aluminium chloride solution or pH-anti-perspirant cream, and most of the patients had tried Ercoril® (proprantheline) lotion which in some cases had been supplemented by Ercoril® tablets. All treatments had been unsatisfactory. All patients in group I had considered surgery and 2 patients were referred to the dermatological department for



Fig. 1. Still-life with roll-on applicator and the remedies used for occlusive dressing and sweat collection.

this purpose. Ten patients in group II had considered surgery and 2 were referred to the dermatological department therefor.

Mode of application. The preparation was applied on the hairy part of the axilla with a roll-on applicator just before bedtime, experience showing the axilla to be driest at this time of the day. If the patients wanted to shave the axillas, 48 hours had to elapse before application. It was recommended not to wash the axillas just prior to application. After application the axillas were air-dried, and on the following morning they were cleaned with soap and water. The axillas were treated twice a week on two successive nights.

Group I: After application the axillas were covered ad modum Shelley & Hurley (7) with plastic foil (Oclufol®). The foil was fixed with a bandage, cotton wool pads, and a close-fitting T-shirt. Plaster was not used. During the first 2 weeks only the right axilla was treated. The roll-on applicator and the remedies used for occlusion and sweat measurements are shown in Fig. 1.

Group II: Same treatment as for group I but without plastic foil occlusion. During the first week only the right axilla was treated.

Treatment control. During controls the patients were interviewed about side effects and the effect of the treat-

ment. An objective examination was carried out together with sweat measuring. The latter was performed with the patient lying at rest. A previously weighed tissue paper (Kleenex® 3 layers No. 3122-10) was placed in both axillas covering the hairy part. Then the axillas were covered with plastic foil (Oclufol®) fixed on all sides with Micro-pore® plaster. The tissue paper was removed after 10 minutes and at once placed in plastic cups with tight fitting covers. Previous and subsequent weighings were made with the tissue paper placed in the same plastic cup and the surplus was regarded as constituting the amount of sweat. The measurements were made before the trial started and at the weekly control (the day before a new course of treatment) during the initial 4 weeks, after this at the monthly controls.

In group II the measuring during rest was supplemented with measuring during 10 minutes of fixed work on a two-step ladder at a rate of 100 steps per minute.

RESULTS

Group I. Two out of 11 patients had to stop the treatment because of unbearable subjective local irritation after one and 3 months respectively. The

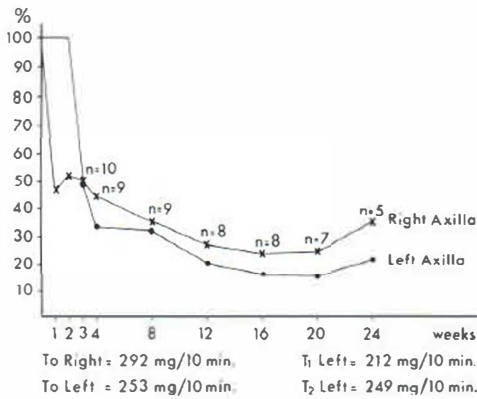


Fig. 2. Amounts of sweat collected during 10 min from right and left axilla, estimated in percentages of the initial sweat production in untreated axilla. 11 patients with axillary hyperhidrosis (group I).

remaining patients were observed for 3–6 months ($\bar{x}=4\frac{1}{2}$ months) from May to October 1976. As described above, plastic foil occlusion was used initially, but at the final controls all patients had individualized the treatment to meet their various needs. Most of the patients had discontinued the occlusion and used local application 1–2 times weekly while one patient used occlusion treatment once every 2 weeks.

Fig. 2 shows the effect of the treatment based on sweat measurements. The sweat production is given in percent and the 100% value is an average of all measurements of both right and left axilla before treatment. An immediate effect was seen in the right axilla, and 2 weeks later when treatment was started, an immediate effect in the left axilla too. The sweat secretion was further limited during the ensuing weeks and then stabilized at a low level.

The initial sweat production (T_0) was found a little lower in the left axilla and a slight drop in the production was registered in the untreated left axilla after starting treatment (T_1 and T_2).

Subjectively, all patients mentioned smarting and itching a few hours after the first application. Often these side effects were temporary and decreased after washing. The discomfort decreased gradually and among the 9 patients who completed the treatment only 3 had slight, temporary inconvenience at the final control. All patients found the treatment entirely satisfactory. No signs of toxic eczema or miliaria were seen.

Group II. All 12 patients completed the treatment and were observed for 2–5 months ($\bar{x}=3$ months)

from October to February 1976–77. The effect of the treatment was determined by sweat measurements in connection with the controls which took place one week after the last treatment (on the day preceding a new treatment) and is shown in Fig. 3. The calculations were made in the same way as for group I. The measuring made during 10 min of work is also given.

An immediate reduction in sweat production was found, both during rest and at work. The reduction increased during the first weeks and then remained stable.

As for Group I, the initial sweat production (T_0) was found to be slightly lower in the left axilla, and a slight drop in the production was registered in the untreated left axilla (T_1) after starting treatment of the right.

Subjectively, 8 out of 12 patients mentioned transient local irritation after application. These inconveniences were present mainly during the early treatments. At the final control all patients reported the treatment to be satisfactory.

DISCUSSION

The selection of patients was based mainly on subjective complaints which induced them to seek medical advice. It is difficult to establish an objective standard for the degree of hyperhidrosis, as the sweat production varies a great deal, particularly due to mental strain. The simple method of measuring employed is used in order to determine the

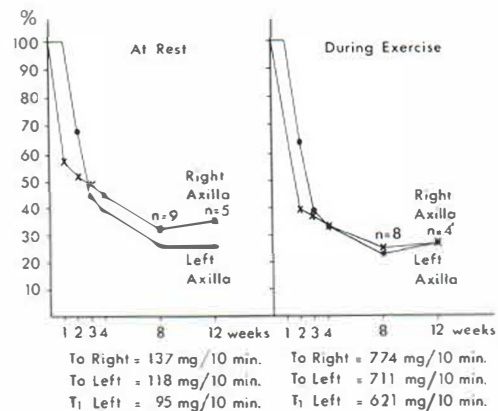


Fig. 3. Amounts of sweat collected during 10 min at rest and during exercise, estimated in percentages of the initial sweat production in untreated axilla. 12 patients with axillary hyperhidrosis (group II).

effect of treatment. The method seems adequate and reliable, as the sweat production measured in the untreated right and left axilla during rest corresponds well in each patient.

The slight drop in sweat production registered in the untreated left axilla after starting treatment of the right is probably due to a placebo effect, established through better knowledge of the test procedure and confidence in the examiner. However, this drop is considerably less than in the treated axilla. We have tried to eliminate the placebo effect by measuring the sweat production during work, where the same good treatment effect was found.

According to Shelley & Hurley (7) preliminary sweat measurements have proved the effect to be at a maximum during the first days of application and using occlusive dressing, after which the sweat production increased slowly for the next 2–3 weeks. Thus our measurements, which were made one week after treatment, do not show the maximum effect, and the patients also reported the axillas to be completely dry during the first days after treatment, both during rest and during physical activity, e.g. sports, after which an increased moistness was gradually registered.

Like Shelley & Hurley (7) we too found a good effect of the treatment including plastic occlusion but, unlike their examinations, ours registered the same good effect when omitting the occlusive treatment.

Groups I and II seem comparable as to subjective sweat discomfort and the objectively registered sweat production, although the initial sweat production was found slightly lower in group II. Group I may, however, have been under a heavier strain by being controlled during the warm summer months.

The tendency to local irritation can be reduced if the application is made in the evening when the axillas are reputedly driest. Often, the discomfort was transient, but in some cases it necessitated washing of the axillas a few hours after the first applications, especially if the discomfort interfered with sleep. In all cases the discomfort decreased during the observation period. In group I hardly any patients had discomfort at the final control, whereas most of the patients in group II had slight complaints. This could be due to the shorter observation period for group II. It is decisive for the treatment result to support the patients by close controls during the initial treatment period until possible dis-

comfort has diminished or passed. The discomfort seems to be an obstacle to the introduction of this anti-perspirant on the market, without prescription. If the preparation is used without medical instructions, detailed written directions should be supplied.

The mechanism of the effect has not been definitely established. The occlusion of the sweat duct is proposed to be an emphysema resulting from the in situ hydroxide gel formation of aluminium chloride that has diffused down the sweat duct (6). The antiperspirant effect may also be caused by necrosis of the outer portion of the duct (6) and fibrillar contraction of the intra duct keratin and thereby a functional occlusion (7).

The local treatment mentioned seems able to compete with the effect following a plastic surgery operation. Also, the transient or permanent side effects of such operations in the form of slow wound healing, hematomas, cicatricial tightening, keloids and lack of hair are avoided. We find that patients suffering from hyperhidrosis axillae and who have been resistant to previously used antiperspirants should be treated locally like patients in the second group (II). Should the effect prove unsatisfactory, plastic foil occlusion could be used as in group I. Any patients who do not obtain good results from the treatment or who suffer unacceptable side effects should then be offered an operation.

REFERENCES

1. Andersen, E. B., Burchardt, H. & Taarnhøj, P.: Axillary hyperhidrosis. *JAMA* 231: 1026, 1975.
2. Bretteville-Jensen, G.: Radical sweat gland ablation for axillary hyperhidrosis. *Br J Plast Surg* 26: 158, 1973.
3. Hurley, H. J. & Shelley, W. B.: A simple surgical approach to the management of axillary hyperhidrosis. *JAMA* 186: 109, 1963.
4. — Axillary hyperhidrosis. Clinical features and local surgical management. *Br J Dermatol* 78: 127, 1966.
5. Jemec, B.: Abrasio axillae in hyperhidrosis. *Scand J Plast Reconstr Surg* 9: 44, 1975.
6. Reller, H. H. & Luedders, W. L.: Pharmacologic and toxicologic effects of topically applied agents on the eccrine sweat glands. *In* *Dermatotoxicology and pharmacology* (ed. F. N. Marzulli & H. J. Maibach), pp. 1–54. Hemisphere Publishing Corporation, Washington, 1977.
7. Shelley, W. B. & Hurley, H. J.: Studies on topical antiperspirant control of axillary hyperhidrosis. *Acta Dermatovener (Stockholm)* 55: 241, 1975.
8. — Axillary hyperhidrosis. *JAMA* 233: 1257, 1975.

9. Skoog, T. & Thyresson, N.: Hyperhidrosis of the axillae. A method of surgical treatment. *Acta Chir Scand* 124: 531, 1962.
10. Stillians, A. W.: The control of localized hyperhidrosis. *JAMA* 67: 2015, 1916.
11. Takats, G. D.: Surgical treatment of hyperhidrosis. *Arch Dermatol* 76: 31, 1957.

Received February 14, 1978

Flemming Brandrup, M.D.
Favrholmvej 79
DK-3400 Hillerød
Danmark