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آموزش مهارت های کاربردی در تدوین و چاپ مقاله
The Effect and Persistency of 1% Aluminum Chloride Hexahydrate Iontophoresis in the Treatment of Primary Palmar Hyperhidrosis

Khosro Khademi Kalantari*, Afsane Zeinalzadea, Farzad Kobarfardb and Salman Nazary moghadamc

aDepartment of Physiotherapy, Faculty of Rehabilitation, Shahid Beheshti University of Medical Sciences, Tehran, Iran. bDepartment of Medicinal Chemistry, School of Pharmacy, Shahid Beheshti University of Medical Sciences, Tehran, Iran. cFaculty of Rehabilitation, University of Social Welfare and Rehabilitation Sciences (USWRS), Tehran, Iran.

Abstract

Topical solutions containing aluminum chloride are known to be the first line of therapy for hyperhidrosis. Palmar hyperhidrosis however, is less responsive to aluminum chloride therapy and successful treatment may require 6-8 h application of high concentrations up to 30% that commonly leads to skin irritation. The purpose of this study is to investigate the effect of 30 min iontophoretic application of low concentration (1%) aluminum chloride solution in patients with palmar hyperhidrosis.

Iontophoresis of 1% aluminum chloride was applied to one hand of twelve patients with palmar hyperhidrosis for four successive days. The subjects’ other hand was treated topically with the same solution at the same time. Gravimetric and iodine-starch tests were performed at baseline, 3 days, 1, 2, 3 and 4 weeks after the last treatment. Experimental hand showed significant hypohydrosis from the 3rd day until the 4th week post-treatment (p < 0.04) which was lower than the control hand throughout the follow-up period. Iontophoresis of low concentration aluminum chloride hexahydrate can induce hypohydrosis that is more persistent than its topical application and with no side effects.

Keywords: Iontophoresis; Aluminum chloride; Palmar hyperhidrosis; Hexahydrate.

Introduction

Primary focal hyperhidrosis is an idiopathic hyperhidrosis. Palmar hyperhidrosis however, is less responsive to aluminum chloride therapy and successful treatment may require 6-8 h application of high concentrations up to 30% that commonly leads to skin irritation. The purpose of this study is to investigate the effect of 30 min iontophoretic application of low concentration (1%) aluminum chloride solution in patients with palmar hyperhidrosis.

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Introduction

Primary focal hyperhidrosis is an idiopathic disease defined by excessive sweating exceeding the needs of thermoregulation that typically affects the axillae, palms, soles, and face. In most of the cases, there is no underlying disease and generally it is worsened by emotional stress rather than heat or exercise (1). The primary defect in patients with hyperhidrosis may be hypothalamic hypersensitivity to emotional stimuli from the cerebral cortex (2).

Current therapeutic strategies include topical aluminum salts, tap-water iontophoresis, application of anticholinergic agents such as Botulinum toxin, local surgical approaches, and sympathectomies. These treatments, however, have been limited by a relatively high incidence of adverse effects and complications.

Aluminum chloride is commonly used in the treatment of hyperhidrosis (PHH) (3). Several studies have shown that aluminum salts can cause an obstruction of the distal sweat gland ducts (4,
A mechanism underlying this obstruction has been proposed as: the metal ions precipitate with mucopolysaccharides, damaging epithelial cells along the lumen of the duct and forming a plug that blocks sweat output. While it is used in regular antiperspirants, hyperhidrosis sufferers need a much higher concentration to be able to treat the symptoms of the condition effectively. A 15% aluminum chloride solution or higher usually takes about a week of nightly use to stop the axillary sweating, with one or two nightly applications per week to maintain the results (6). The solution is usually not effective for hyperhidrosis (7) and successful treatment may require 6-8 h application of high concentrations up to 30% (8). An aluminum chloride solution can be very effective; some people, however, cannot tolerate the dermatitis that the high concentration solution can cause.

Although the ionic composition of aluminum chloride solution and the suggested mechanism of its effect make it suitable for iontophoresis, investigated yet. Therefore, we investigated induced by low concentration of aluminum chloride hexahydrate (1%) delivered by 30 min iontophoresis in patients with primary palmar hyperhidrosis.

Experimental

Twelve subjects (6 females and 6 males) with primary hyperhidrosis, aged 20-32 years (23.17 ± 3.6) participated in this experimental study. Patients were selected and referred according to the following criteria by a dermatologist:

**Excessive palmar perspiration and excessive sweating for more than one year.**

Patients with organic disease, such as hyperthyroidism were excluded in this study. Informed consent was obtained from all patients after full written and oral explanation. The research followed the tenets of the Declaration of Helsinki promulgated in 1964 and was approved by the ethics committee of Shahid Beheshti University of Medical Sciences.

Iontophoresis of aluminum chloride hexahydrate was applied to one hand, selected randomly from the dominant and non-dominant side (5 non-dominant and 7 dominant hands), using a galvanic stimulator (Enraf Nonius, Dynatron 438, Netherlands) with the intensity of 12 mA for 30 min. The iontophoretic treatment was repeated for four successive days. The other hand was regarded as control and treated with topical method. The active electrode covered the palmar surface of the hand from metacarpophalangeal crease to distal wrist crease. The indifferent electrode was placed on the anterior surface of the forearm. Anode was selected as the active electrode. In this study, 1% aluminum chloride hexahydrate solution in ethyl alcohol was used for treatment. This low concentration of aluminum salt was selected to curtail the possible side effects (9). Twenty milliliter of solution was delivered by iontophoresis to the experimental hand in each session. A thin layer of absorbent pad was used to retain the solution under the electrodes. The same amount of solutions was also used for the control hand and the remaining was washed out after 30 min.

All patients underwent one pre-treatment and 5 post-treatment evaluation at 3 days, 1, 2, 3 each evaluation session, they were acclimatized in a temperature and humidity controlled room (temperature 25°C and relative humidity 60%) for 15 min. Gravimetric and iodine-starch tests were performed to evaluate the sweat production rate. For the gravimetric test, we used a standardized laboratory scale (with the accuracy of 0.0001 g). The patient’s hand was then placed on the paper while the forearm was rested on the table weight of the upper limb. After exactly 1 min, the paper was weighed again, indicating the rate of sweat secretion milligrams per min. The iodine-starch test consisted of painting a solution made up of 2 g of iodine and 4 g of potassium iodine in alcohol to 100 mL over the skin of the hand and was applied and after 2, 5 and 8 min digital photos were taken. Sweat causes the color of the powder to turn dark blue. A repeated-measures ANOVA with post-hoc Bonferroni test was used to compare the sweat intensities at different evaluation sessions.

Results and Discussion

The sweating rate of the control and difference at the base line. The mean sweating rate was reduced in both hands post-treatment. In experimental hand, the reduction was statistically 4th day, 1st, 2nd, 3rd and 4th week (p < 0.04) after the treatment (Figure 1). In the control hand, however, the sweat reduction was only 3rd week post-treatment (p < 0.05). The least sweating rate was at 3rd day and 1st week after the treatment in the experimental hand (mean reduction of 77% and 65% respectively) and 3rd day after the treatment in the control hand (mean reduction of 72%). The mean sweating rate of the experimental hand was lower than the control hand at all post-treatment evaluations, however, the differences between the hypohidrosis induced by iontophoresis and topical application of aluminum chloride 2nd week (p < 0.03) (Figure 2).

No skin irritation was observed during the trial except for one subject who experienced a mild and transient itching sensation.

An iontophoretic application of as low as 1% aluminum chloride hexahydrate is shown to considerably reduce the palmar sweating rate with long endurance and least skin irritation compared to topical method. The possibility of using low concentration of aluminum chloride solution and the short-time exposure to it are the merits for iontophoretic application of the solution.
the positively charged drug ions away from the electrode and into the skin. Obviously, negatively charged ions will behave in the same manner.

In iontophoresis, the transmission of drugs and chemicals through the body is forced by direct current delivery for the treatment of focal hyperhidrosis. In the only published study, a combination of aluminum salt in treatment of focal hyperhidrosis. Applied direct current alone can reduce the sweating rate, however, continuous application is required since the results are often short-lived (few days) with a wide range of use in dermatological practice (8, 14), no study has been published yet about the iontophoretic application of pure aluminum salt in treatment of focal hyperhidrosis.

In the only published study, a combination of glycicyprrolate and aluminum chloride was delivered by iontophoresis for the treatment of patients with palmar hyperhidrosis (9) which raises the ambiguity of the contribution of each element to the outcome of this experiment.

Different mechanisms of iontophoretic transport for ionic and neutral perimts have been suggested as electrophoresis and electroosmosis, respectively. When a low electric field is applied across the human skin who can not tolerate the long-period contact and after treatment with botulinum toxin: results of an life assessment in patients with hyperhidrosis before and after treatment with botulinum toxin: results of an open-label study. Clin. Dermatol. (2002) 20: 638-42.

The method used in this study consisted of two effective elements; direct current and aluminum salt. Each of them is considered effective in the treatment of hyperhidrosis. Applied direct current alone can reduce the sweating rate, however, continuous application is required since the results are often short-lived (few days).

The positively charged aluminum chloride applied to the control hand produced hyperhidrosis but still with low endurance. It can be concluded that the induced long-lasting hyperhidrosis in the present experiment is most likely related to the accumulative effect of both elements contributed in iontophoresis of aluminum salt. This could result in more intense and long-lasting occlusion of the sweat glands in the iontophoretic hand compared to the control one.

Iontophoretic application of aluminum salt can be considered as a non-invasive and a safe alternative treatment method especially in the patient with palmar hyperhidrosis and sensitive skin who can not tolerate the long-period contact with topical solutions.

References


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