Treatment of palmoplantar hyperhidrosis

R.S. Altman and R.A. Schwartz

SUMMARY

Palmoplantar hyperhidrosis, excessive sweating from the palms and soles, is often an embarrassing and disabling condition that afflicts individuals of all ages. Diagnosis is usually evident based upon the history and visible signs of sweating. Treatment of this condition has proven to be difficult; however, numerous treatment options are now available. The therapeutic armamentarium includes topical and systemic agents, iontophoresis, botulinum toxin injections, and sympathectomy, all of which will be discussed.

KEY WORDS

Hyperhidrosis, Excessive Sweating, Treatment, Iontophoresis, Sympathectomy

Introduction

Hyperhidrosis, an excessive rate of sweat secretion from the eccrine glands, is a disabling condition that affects both children and adults. With an incidence rate of 0.6 to 1% documented in the young Israeli population[1] and onset usually during childhood or adolescence, palmoplantar hyperhidrosis (excessive sweating of the palms and soles) has been noted to occur twenty times more frequently in the Japanese than in any other ethnic group.[2,3] Palmoplantar hyperhidrosis may frequently be observed in chronic alcohol abusers.[4] Unlike sweating on the remainder of the body, palmoplantar hyperhidrosis is induced by emotions, not thermoregulation. Hyperhidrosis of the palms and soles is remarkable in that it does not occur during sleep or sedation because the hypothalamic sweat control center receives input from the cerebral cortex. This varies from the thermoregulatory hypothalamic center controlling sweating from the rest of the body. Individuals with hyperhidrosis have morphologically and functionally normal eccrine glands however, their glands are hypersensitive to stimuli in the hypothalamic sweat centers.[5] Patients with palmoplantar hyperhidrosis have hypothalamic sweat centers that are hypersensitive to emotional stimuli of cerebral origin.[6] The number of eccrine sweat glands per individual varies from two to four million with the greatest density on the palms and soles.[5]

Diagnosis is evident by the history and visible signs of sweating. Many patients complain of social embarrassment and work-related disability due to palmoplantar hyperhidrosis. Unfortunately, this condition has not been easy to treat. Fortunately, many treatment options, including topical and systemic agents,

iontophoresis, botulinum toxin injections, and sympathectomy, are now available.

Treatment

Therapy can be challenging both for patient and physician. Fortunately, numerous medical, surgical and electrical treatment options are now available. Treatment may require visualization of the affected area, which may be accomplished by the iodine starch test (spraying the area with a mixture of 0.5 to 1 gram of iodine crystals and 500 grams of soluble starch). The treatment options include topical and systemic medications, iontophoresis, injections of botulinum toxin, and sympathectomy:

Numerous topical chemicals have been utilized including topical anticholinergics, boric acid, 2-5 % tannic acid solutions, resorcinol, potassium permanganate, formaldehyde, glutaraldehyde, and methenamine. Sensitization may result with formaldehyde use.[7] 20 % aluminum chloride hexahydrate in absolute anhydrous ethyl alcohol (Drysol®) has been considered to be the most effective topical agent. This product should be used nightly on dry skin with or without occlusion until a positive result is obtained, at which time the intervals may be lengthened. At morning, the remainder of the aluminum chloride should be washed off and neutralized with an application of topical baking soda powder in order to minimize irritation.[8] The mechanism of action of aluminum chloride may be due to a poral obstructive effect, thereby diminishing sweating, in addition to atrophy of the secretory cells seen in eccrine sweat glands.[6]

Systemic anticholinergic agents including propantheline bromide (Probanthine®), glycopyrrolate (Robinul®), oxybutynin (Ditropan®), and benztropine (Cogentin®) may be effective because, although the eccrine sweat glands are innervated by the sympathetic nervous system, the periglandular neurotransmitter is acetylcholine. However, anticholinergics have a poor side effect profile (including mydriasis, blurry vision, dry mouth and eyes, difficulty with micturition, and constipation) which renders their use unappealing to many sufferers of hyperhidrosis. Many individuals understandably do not want to use these agents on a long-term basis as is required. Other systemic medications that may be beneficial for patients with unwanted palm and sole sweating include sedatives and tranquilizers, indomethacine[9], and calcium channel blockers (Diltiazem®)[10]. Calcium channel blockers have been found to be effective because they block the essential primary step of calcium influx into the eccrine secretory cell, thereby preventing the stimulatory signal for the secretion of water and electrolytes from the secretory cell.[11] Most patients find both the topical and systemic agents ineffective in abolishing their hyperhidrosis, leading them to search for other options.

Iontophoresis, introduced in 1952[12], is one of the most effective, safe and inexpensive treatment options available.[13-15] It consists of passing a direct current (DC) across the skin. A representative study showed that in 25 patients with palmar hyperhidrosis, symptoms were abated after an average of 11 treatments (30 minutes per treatment at least four times per week) of either DC or AC/DC tap water iontophoresis. However, for undiscussed reasons, alternating current (AC) iontophoresis was found to be essentially ineffective after 25 treatments.[16] 55 % of these 25 patients noted a family history of palmar hyperhidrosis.[16] The side effects noted were burning and tingling of the treated area, irritation (erythema and vesicles), and the induction of possible burns at areas of minor skin injury.[16] Numerous agents have been used in iontophoresis including tap water and anticholinergics. In order to induce hypohydrosis, treatment of each palm or sole for 30 minutes at 15 to 20 milli-amperes (mA) daily in tap water iontophoresis is required.[17] Intact skin can endure 0.2mA/cm^2 of galvanic current without negative consequences and up to 20 to 25 mA per palm may be tolerated. [17] The mechanism of action of iontophoresis is unknown. One speculation was that iontophoresis induced poral hyperkeratosis, thereby promoting poral plugging and inhibition of sweat secretion.[18] However, no such poral plugging was found.[19] Tap water iontophoresis is more effective than saline iontophoresis.[20] Iontophoresis with anticholinergics is more effective than tap water iontophoresis, but may induce systemic side effects.[21] Palmoplantar hyperhidrosis may be effectively treated with 10 to 12 treatments (30 minutes at 15-20 mA at least three times per week) and one to two maintenance doses per week of tap water iontophoresis, with the only complication being mild skin irritation.[13] With the initial treatment, patients found worsening of their condition, but this resolved after three to five treatments.[13] Complete abolition of sweating was found to last one to two weeks and sweating quickly returned without maintenance therapy.[13] A newer study incorporated both, anticholinergics and aluminum chloride for one hour daily. It diminished the sweat secretion (via the anticholinergic) and caused blockage of the sweat gland (via the aluminum chloride).[22] This combination iontophoresis treatment compared to tap water iontophoresis resulted in a remission period of 20 days versus 3.5 days and a reduction in severity of symptoms of –3.1 versus -1.5 .[22] A device for use at home (the Drionic®) is now available and makes this treatment option more accessible.

Botulinum toxin injection is a newer therapeutic modality. The mechanism of action is due to the anticholinergic effects at the neuromuscular junction and in the postganglionic sympathetic cholinergic innveration of the sweat glands.[23] Four patients with severe hyper-

hidrosis were treated with 50 subepidermal injections of 2 mouse units per palm (after receiving regional median and ulnar nerve blocks) resulting in anhidrosis that lasted from 4 to 12 months.[24] Each injection produced a 1.2 cm diameter of anhidrosis. The only side effect noted was mild transient thumb weakness in one of the patients that subsequently resolved in three weeks. A randomized double-blind study of 11 patients with palmar hyperhidrosis received 120 mU of botulinum A toxin (6 sites) in one palm versus saline solution in the other palm which resulted in a mean reduction of sweat production in the palm treated with the toxin of 26 percent after three and eight weeks and 31 percent after 13 weeks.[25] The only side effects noted were a minor muscle weakness at the toxin treated sites in all of the patients, that resolved after two to five weeks, as well as minor hematomas at the injection sites in one patient.[25] These injections must be repeated at varying intervals in order for long-term results to be maintained.

Sympathectomy involving the surgical destruction of the ganglia contributing to the hyperhidrosis, has been used as a permanent but effective treatment option for hyperhidrosis since 1920, usually reserved as the ultimate treatment modality.[26] The second and third thoracic ganglia are responsible for palmar hyperhidrosis. This procedure is usually not carried out for plantar hyperhidrosis due to the risk of sexual dysfunction.[6] Numerous complications plague this treatment option, including compensatory sweating (induction of sweating in previously unaffected parts of the body), gustatory sweating, pneumothorax, intercostal neuralgia, Horner's syndrome, sequelae of general anesthesia and return of the hyperhidrosis. The endoscopic thoracic approach has recently been favored over the traditional open approach due to reduced complications and diminished surgical times and scars. Of 47 patients afflicted with palmar hyperhidrosis treated with an outpatient thoracoscopic limited sympathectomy via electrocautery, there were no recurrences after 12.8 months, and mild compensatory sweating was reported in 74.5 percents with no incidences of Horner's syndrome.[27] Of 850 patients treated with bilateral endoscopic transthoracic sympathectomy, 98% were pleased with the results 31 months post-surgery.[28] The complications noted were hemothorax/pneumothorax in 1%, treatment failures in 2%, and recurrence of symptoms in 2% of the patients.[28] Compensatory sweating (mostly on the trunk) occurred in 55% of those treated, with 2% of those affected stating that the compensatory sweating was comparably distressing as was their initial hyperhidrosis.[28] In addition, gustatory sweating was noted in 36%, and a 10% reduction in heart rate was found in 15% of the patients. In a similar study of 72 patients with palmar hyperhidrosis treated with transthoracic endoscopic sympathectomy, a success rate of 93% was reported, with an alarming rate of compensatory sweating in 71 of the 72 patients (described as moderate in 41.7% and severe in 43.1%), gustatory sweating in 17%, Horner's syndrome in 7%, pneumothorax in 8%, and intercostals neuralgia in 7% of the patients.[29] Despite the 93% success rate, only 77.7% of the patients were pleased with the results, due to the side effects.[29] Treatment of the compensatory sweating that results following transthoracic endoscopic sympathectomy can be effective with botulinum toxin intradermal injections.[30]

Conclusion

Effective treatment modalities vary from patient to patient requiring the physician to experiment with numerous options before finding the most efficacious choice. Suggested first line methods include 20% alminium chloride hexahydrate in anhydrous ethyl alcohol topically, and iontophoresis. Some prefer botulinum injections. As a last resort for relief from hyperhidrosis, one may consider surgical sympathectomy.

REFERENCES

1. Adar R, Kurchin A, Zweig A, Moses M. Palmar hyperhidrosis and its surgical treatment: a report of 100 cases. *Ann Surg* 1977; 186:34-41.

2. Cloward RB. Treatment of hyperhidrosis palmaris (sweaty hands). A familial disease in Japanese. *Hawaii Med J* 1957; 16:381-9.

3. Cloward RB. Hyperhidrosis. *J Neurosurg* 1969; 30:545-51.

4. Tugnoli V, Eleopra R, DeGrandis D. Hyperhidrosis and sympathetic skin response in chronic alcoholic patients. *Clinical Autonomic Research* 1999; 9:17-22.

5. Wenzel FG, Horn TD. Nonneoplastic disorders of the eccrine glands. *J Am Acad Dermatol* 1998; 38:1-17.

6. Stolman LP. Treatment of hyperhidrosis. *Dermatologic Clinics* 1998; 16:863-7.

7. Shelley WB, Laskas JJ, Satonove A. Effect of topical agents on plantar sweating. *Arch Dermato and Syphilology* 1954; 69:713-6.

8. Sato K, Kang WH, Saga K, Sato KT. Biology of sweat glands and their disorders. II. Disorders of sweat

gland function. *J Am Acad Dermatol* 1989; 20:713-26.

9. Tkach JR. Indomethacine treatment of generalized hyperhidrosis. *J Am Acad Dermatol* 1982; 6:545.

10. James WD, Schoomaker EB, Rodman MC. Emotional eccrine sweating. A heritable disorder. *Arch Dermatol* 1987;123:925-9.

11. Sato K. The physiology, pharmacology and biochemistry of the eccrine sweat glands. *Rev Physiol Biochem Pharmacol* 1977; 79:51-131.

12. Boumann HD, Grunewald-Lentzer EM. The treatment of hyperhidrosis of the hands and feet with a constant current. *Am J Phy Med* 1952; 31:158-69.

13. Holze E, Alberti N. Long-term efficacy and side effects of tap water iontophoresis of palmoplantar hyperhidrosis: the usefulness of home therapy. *Dermatologica* 1987; 175: 126-35.

14. Levit F. Simple device for the treatment of hyperhidrosis by iontophoresis. *Arch Dermatol* 1968; 98:505-7.

15. Stolman LP. Treatment of excess sweating of the palms by iontophoresis. *Arch Dermatol* 1987; 123:893-6.

16. Reinauer S, Neusser A, Schauf G, Holzle E. Iontophoresis with alternating current and direct current offset (AC/DC iontophoresis): a new approach for the treatment of hyperhidrosis. *Br J Dermatol* 1993; 129:166-9.

17. Sato K, Ohysuyama M, Samman G. Eccrine sweat gland disorders. *J Am Acad Dermatol* 1991; 24:1010-4.

18. Shelley WB, Horvath P, Weidman F, Pillsbury DM. Experimental miliaria in man. I. Production of sweat retention anhidrosis and vesicles by means of iontophoresis. *J Invest Dermatol* 1948; 11:275-91.

19. Hill AC, Baker GF, Jansen GT. Mechanism of action of iontophoresis in the treatment of palmar hyperhydrosis. *Cutis* 1981; 28:69-72.

20. Timm D, Meletiou DS, Sato K. Mechanism of galvanic current-induced inhibition of palmar sweating in hyperhidrotic patients. *Clin Res* 1987; 35:721A

21. Abell E, Morgan K. The treatment of idiopathic hyperhidrosis by glycopyrronium bromide and tap water iontophoresis. *Br J Dermatol* 1974; 91:87-91.

22. Shen JL, Lin GS, Li WM. A new strategy of iontophoresis for hyperhidrosis. *J Am Acad Dermatol* 1990; 22:239-41.

23. Bushara KO, Park DM, Jones JC et al. Botulinum toxin – a possible new treatment for axillary hyperhidrosis. *Clin Exp Dermatol* 1996; 21:276-278

24. Shelley WB, Talanin NY, Shelley ED. Botulinum toxin therapy for palmar hyperhidrosis. *J Am Acad Dermatol* 1998; 38:227-9.

25. Schnider P, Binder M, Auff E, Kittler H, Berger T, Wolff K. Double-blind trial of botulinum A toxin for the treatment of focal hyperhidrosis of the palms. *Br J Dermatol* 1997; 136:548-52.

26. Kotzareff A. Resection partielle de trone sympathetique cervical droit pour hyperhidrose unilaterale. *Rev Med Suisse Romande* 1920; 40:111-3.

27. Hsia JY, Chen CY, Hsu CP, Shai SE, Yang SS. Outpatient thoracoscopic limited sympathectomy for hyperhidrosis palmaris. *Ann Thorac Surg* 1999; 67:258-9.

28. Drott C, Gothberg G, Claes G. Endoscopic transthoracic sympathectomy: an efficient and safe method for the treatment of hyperhidrosis. *J Am Acad Dermatol* 1995; 33:78-81.

29. Lai YT, Yang LH, Chio CC, Chen HH. Complications in patients with palmar hyperhidrosis treated with transthoracic endoscopic sympathectomy. *Neurosurgery* 1997; 41:110-3.

30. Heckman M. Complications in patients treated with palmar hyperhidrosis treated with transthoracic endoscopic sympathectomy. *Neurosurgery* 1998; 42:1402-4.

AUTHORS' ADDRESSES

Rachel S. Altman, MD, UMDNJ-New Jersey Medical School, Newark.
Reprints: Robert A. Schwartz, MD, MPH Dermatology, UMDNJ-New Jersey Medical School, 185 South Orange Ave, Newark, NJ 07103-2714, Telephone (973) 972-6884, Fax (973) 972-5877, e-mail: roschwarŽumdnj.edu
Robert A. Schwartz, MD, MPH, professor and chairman, same address.