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Essential hyperhidrosis—pathogenesis and treatment

Report of Seven Cases Treated by Upper Thoracic Sympathectomy

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SWEATING normally subserves the important function of body thermoregulation; however, in hyperhidrosis, sweating is excessive and apparently without useful purpose. The hyperhidrosis is most pronounced on the hands, particularly on the palmar surfaces, although the feet and axillae may be similarly affected. The incidence is most common among teenagers and young adults, though some children are aware of the problem in the first decade of life.

When severe, the condition is most embarrassing socially, particularly when the patient must greet others with a handshake. It may prove to be a serious employment handicap for anyone who must meet and associate with clients in business. It is likewise a serious detriment to those who work with their hands, such as stenographers, artists, and draftsmen, because their creative work is constantly threatened by damage from perspiration.

In advanced cases, when medical treatment fails to control the symptoms, it may prove necessary to perform upper thoracic sympathectomy, which seems to be the most effective means of curing the problem. This paper is a report of seven patients with essential hyperhidrosis who were surgically treated at the Cleveland Clinic Hospital.

Pathogenesis

The term essential hyperhidrosis is used because the etiology is not known. Sweating may be produced either by apocrine or by exocrine sweat glands. The apocrine glands are confined to the axillary and pelvic regions, and to the areolar area of the nipples, and have no thermoregulatory function. The exocrine glands are located everywhere in the skin and are concerned mainly with thermoregulatory control, sweat production being stimulated primarily by increases in environmental temperature. Thermoregulatory sweating is most pronounced on the forehead, dorsa of the hands, on the chest, and on the neck.[1, 2]

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The exocrine glands may also produce sweat in response to emotional or sensory stimuli, in which case the secretion is largely confined to the palms and soles, although it may also occur in the axillae. Essential hyperhidrosis probably represents a disorder of exocrine gland sweating in response to the latter type of stimuli.

Both types of exocrine sweating (thermoregulatory and emotional) are under the control of the central nervous system: 'thermal' sweating by the temperature-regulating center in the hypothalamus, and 'emotional' sweating possibly by some other cerebral center. Ultimately, descending pathways pass through the brain stem to the spinal cord where connection by synapse is made with sympathetic neurons in the lateral gray matter of the first through the twelfth thoracic segments. The innervation of the sweat glands is through the sympathetic nervous system, although they are paradoxically cholinergic in action, being stimulated by acetylcholine and pilocarpine, and inhibited by atropine.

The possibility exists that the cause of hyperhidrosis could be excessive stimulation of the sweat glands by an overactive sympathetic system, or by overreaction of the glands to a normal amount of acetylcholine. Chalmers and Keele[1] found that there was no difference in responses to acetylcholine between normal persons and hyperhidrotic patients, and therefore concluded that the excessive sweating was due to hyperactivity in the central nervous system.

Treatment

Medical treatment has been of little value in severe cases of hyperhidrosis. Anticholinergic agents such as methanthelin bromide have been advocated,[3] but they produce adverse effects when used in doses large enough to control sweating. Locally applied antiperspirators such as formaldehyde are only temporarily effective. Tranquilizers seem to be ineffective despite the emotional implications of the disease. Irradiation of the skin may cause atrophy of the glands, and the roentgen dosage must be such that there is great risk of causing a chronic dermatitis.

The most effective and permanent treatment of the condition is sympathetic denervation of the upper extremities by upper thoracic sympathectomy. This is used only in severe cases that have failed to respond to conservative measures.

Report of cases

Case 1. A 29-year-old Caucasian woman was first examined at the Cleveland Clinic on January 30, 1946, because of nervousness and excessive axillary perspiration since February 1, 1945, when her husband was killed in combat. Atropine, radiation therapy, and local application of formaldehyde gave no relief. The sweating was more prominent in the right axilla. Palms and soles were also wet. On April 24, 1946, she underwent the standard Smithwick dorsal preganglionic sympathectomy on the right side. Six days later, the same procedure was done on the left side. Ten months later she reported complete relief of perspiration in the axillae and upper extremities.

Case 2. A 43-year-old Caucasian man came to the Cleveland Clinic on November 2, 1950, because he sweated profusely on the hands and feet ever since he could remember, particularly during periods of emotional tension. He found this to be a serious handicap in his sales job. Methanthelin bromide orally was ineffective. On December 21, 1950, he underwent right preganglionic sympathectomy at the level of the third thoracic vertebra. Postoperatively his right hand was warm and dry. On July 20, 1951, he underwent left preganglionic sympathectomy, which effectively relieved the left-sided symptoms. No complication followed either operation. He was last examined April 24, 1952, and was found to have warm, dry hands. He had compensatory increased sweating on the trunk and chest.

Case 3. An 18-year-old Caucasian man came to the Cleveland Clinic on November 10, 1959, because of hyperhidrosis of the hands for six years. Although he was a restaurant worker, he wished to enter promotional work, but was embarrassed to shake hands with people. Methanthelin bromide orally was ineffective. The symptoms persisted even when he was at home on the weekends. Upon examination, the palms were cold and dripping wet. Hyperhidrosis also involved the soles and axillae. Hands and feet were mottled and cyanotic. On January 11, 1966, after neurosurgical consultation, he underwent bilateral dorsal sympathectomy with excision of the second and third thoracic ganglia, their rami, and intervening chain. Postoperatively, his hands were warm and dry. Five months later, he had warm dry hands and was working in a job that required him to meet people.

Case 4. A 12-year-old Caucasian girl, interested in art, was first examined at the Cleveland Clinic on February 23, 1966, because of vague complaints of dizziness and fatiguability. The medical workup showed that there was severe hyperhidrosis of the hands and feet. She was treated with formaldehyde and anticholinergics, which did not improve her condition. A right stellate block gave relief of symptoms of the right hand. On December 27, 1967, she underwent bilateral dorsal sympathectomy with good sympathetic denervation of both arms and hands. Three months later there was no sweating in the hands; the feet were much drier than preoperatively.

Case 5. A 21-year-old Caucasian woman, an art student, came to the Cleveland Clinic on August 17, 1966, because of severe hyperhidrosis since the age of seven years. There was similar occurrence in her family. The symptoms were aggravated by heat, tension, and nervousness, as for example while taking an examination. Her art work suffered because of the constant dripping of sweat on the paper. Medical treatment gave no relief. Results of physical examination were normal except for cold, wet feet and hands, and erythematous patches on both axillae. On September 19, 1966, she underwent bilateral dorsal sympathectomy. Recovery was good, and results were excellent in the upper extremities. Three months later she was doing well and her hands were warm and dry.

Case 6. A 20-year-old Caucasian woman was first examined on December 26, 1967, because of severe sweating of the hands, soles, and axillae. She had noticed increased sweating a number of years before, which became excessive in the last few years. The sweating was increased by heat, emotional tension, or any stressful situation. Medical treatment gave no relief. On December 28, 1967, the patient underwent right preganglionic sympathectomy at the second and third thoracic levels. Postoperatively, the right hand was immediately noted to be warm and dry. She was seen three months postoperatively and had a warm right hand and a wet left hand.

Case 7. An 18-year-old Caucasian premedical student came to the Cleveland Clinic on March 18, 1968, because of profuse sweating of his hands and feet all his life. They also were cold and clammy most of the time. He said he was not a nervous person, but the sweating was worse when he was under tension. He tried methanthelin bromide orally which decreased sweating for about an hour, but an adverse effect was dryness of the throat for four hours. Topical formalin and other antiperspirators gave no relief. On examination his hands and feet were extremely wet with perspiration. On March 19, 1968, he underwent bilateral stellate blocks which gave temporary relief. On March 27, 1968, the patient underwent bilateral thoracic sympathectomy, with excision of the second and third thoracic ganglia. Postoperatively, left pneumothorax developed, and a chest tube was inserted. The immediately postoperative course showed warm and dry hands, a condition that still was in effect at the six-month postoperative progress examination.

Discussion

There were several reports of sympathectomy for the treatment of hyperhidrosis during the 1920's and 30's, but few since then. Kotzareff[4] is generally given credit for having first reported this treatment.[5-7]

Some controversy exists in regard to the appropriate method permanently and effectively to denervate the upper extremity of its sympathetic supply. As noted in the case reports, there has been variation in surgical technic in our experience, some patients (cases 1, 2, and 5) having undergone preganglionic sympathectomy, and the other postganglionic sympathectomy. In each case the resection was limited to the second and third thoracic segments and did not include the first thoracic ganglion.

Adson, Craig, and Brown[6] advocated postganglionic cervicothoracic ganglionectomy, but this procedure produces Horner's syndrome, the ptosis of which may be quite disfiguring, especially if unilateral.

Smithwick[8] advised preganglionic resection, including division of the anterior and posterior roots of the second, third, and fourth thoracic segments, all communicating rami to the second, third, and fourth sympathetic ganglia, resection of the fourth ganglion, and encasement in a silk cylinder of the second and third ganglia. All this was done in an attempt to prevent sympathetic nerve regeneration. In patients who have hyperhidrosis, late regeneration has not been a problem. White, Smithwick, and Simeone[9] have advocated resection of the second and third thoracic sympathetic ganglia only, and have obtained satisfactory results.

The necessity of resecting the first thoracic ganglion has been much debated. Ray[10] strongly believed that denervation was incomplete if the first thoracic ganglion were not removed. Hyndman and Wolkin,[11] and more recently Love and Juergens,[12] showed that complete denervation of the upper extremity may be accomplished by the isolated removal of the second thoracic sympathetic ganglion.

Our present method as performed in four patients (cases 3, 4, 5, and 7) is to resect the third rib through an oblique muscle-splitting incision in the paravertebral region. Roentgenographic identification of the correct level is essential. The patient is seated and under endotracheal anesthesia. Both sides are easily operated on under the same anesthesia. Pneumothorax is the main complication to be anticipated. Generally, when it is known that the pleura is open, postoperative pneumothorax may be prevented by closing the wound tightly over a catheter, to which negative pressure is applied while the anesthesiologist increases the intrathoracic pressure.

Excessive perspiration in the areas not denervated may be a problem on occasion, as it was in one patient in our series (case 2). This probably is compensatory and most likely thermoregulatory in function.[13]

Summary

Essential hyperhidrosis, a disease of unknown origin, is characterized by excessive palmar sweating that can be a severe social and economic handi-

cap. Because medical treatment is of little value in severe cases, sympathetic denervation of the upper extremities is often necessary in such cases. Seven such cases treated by upper thoracic sympathectomy are reported. The only complication was unilateral pneumothorax in one patient.

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