Clinical Problems

Role of Sympathectomy for Hyperhidrosis

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Sweat glands are of two main types, eccrine and apocrine. Apocrine glands develop in association with hair follicles and play no part in thermoregulation. They are distributed in the axilla, perineum, and mammary areola and secrete a milky odourless fluid, are probably under the control of circulating adrenaline, and do not appear to be supplied by secretory nerves.¹ On the other hand, eccrine glands are found throughout most of the skin—very dense on the palms and soles but less so in the head and neck, trunk, and upper arms and legs. They are situated deep in the dermis and secrete a dilute solution containing urea and lactic acid. The sodium chloride concentration varies according to the level of adrenocortical activity.² Eccrine glands are important in thermoregulation, are supplied by cholinergic fibres present in sympathetic nerves, and are inhibited by atropine.

Nerve Supply

The spinal centres of the sympathetic nervous system to the upper limb lie chiefly in the fifth to the ninth thoracic segments of the cord (and sometimes also in the second and fourth).² The preganglionic fibres pass via white rami communicantes to the lateral sympathetic chain, then cranially to end in the first or second thoracic and inferior and middle cervical ganglia. The postganglionic fibres arise here and join the nerves of the brachial plexus (C5-T1) constituting their sympathetic roots. They reach the limb via the spinal nerves and are distributed to the arteries, skin, eccrine glands and skeletal muscle vessels.

Stimuli

Generalized sweating due to eccrine secretion occurs after exercise, a rise in temperature, or any other cause of sympathetic activity, such as hypoxia or hypoglycaemia. Localized sweating may be either gustatory or emotional.

Gustatory sweating occurs physiologically on the forehead, upper lip, scalp, and back of the neck as an acquired reflex, beginning at the taste buds when highly spiced food is eaten. It may be excessive and activated by a minimal stimulus after parotidectomy (Frey's syndrome) or occasionally after sympathectomy, and its mechanism is not well understood.

Emotional sweating usually affects the palms, soles of the feet, and axillae, and less commonly the head and neck,

though occasionally such sweating seems to occur spontaneously. The hands are most often affected, so that sweat may drip from the extended fingers when dependent, and handling of paper or materials becomes impossible as they are spoilt. This is particularly distressing at parties or dances; and not only is hyperhidrosis socially unacceptable but it may be incapacitating and even dangerous—for example, in bank clerks and electricians. The feet sometimes are affected worse than the hands, and in severe cases a pair of shoes will rot after a few weeks because of the constant moisture. The head and neck are rarely affected excessively, but one of us (P.M.) treated the chairman of an industrial concern who suffered severely when annoyed by members of his committee. He thought, probably correctly, that sometimes a deliberate attempt to induce an attack was made by unscrupulous persons.

Hyperhidrosis appears to start in childhood, though it may be aggravated by puberty, possibly because of emotional factors, and it seems to persist throughout life. Charles Dickens in *David Copperfield* described the condition well in the character of Uriah Heep.

Treatment

Topical antiperspirant applications are occasionally effective (benzoyl scopolamine hydrobromide, propantheline, and polidine). Atropine-like drugs have been prescribed, but the ocular and salivatory side effects are troublesome. Propantheline has also been used systemically. Sympathectomy is the only guaranteed permanent cure for patients when the above measures fail, as indeed they usually do.

In 1919 Kotzareff attempted sympathetic denervation for hyperhidrosis, and in 1920 demonstrated its efficacy for unilateral hyperhidrosis of the face;³ in 1935 Adson *et al.*⁴ reported successful results in the hands after cervical sympathectomy.

Over the past 20 years we have operated on several patients for this complaint, complete relief always being obtained. During our earlier experience we performed cervical and lumbar sympathectomies on either side, but we soon learnt that this should be avoided, as excessive thermoregulatory sweating occurs in the trunk, which is sometimes an embarrassment in warm weather and may soak the clothes. If all four limbs are affected the choice of whether the hands or the feet should be treated must be made by the patient. The hands are almost invariably chosen for treatment.

Patients

Twenty-eight patients (21 women and 7 men aged 15-36 years) have undergone bilateral cervical sympathectomy for

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TABLE I—Details of 28 Patients Who Underwent Bilateral Cervical Sympathectomy

Case No.	Age and Sex	Symptoms	Length of Symptoms (Years)	Follow-up (Years)	Results			Complications				
					H	A	B	Horner's Syndrome	Pneumothorax	Gustatory Sweating	Axillary Residue	Phrenic Nerve Damage
1	19 F.	H, F	7	7	Good							
2	21 M.	H, F	2	10	"							
3	28 M.	H, F	Always	2	"			Transient	Bilateral Bilateral			
4	20 F.	H, F	"	1	"			"				
5	16 M.	H, F	"	7	"			"				
6	28 M.	H, F	"	0	"			"				
7	19 F.	H, F	"	9	"			Transient				
8	35 F.	H, F	"	9	"			"				
9	20 F.	H, F	"	5	"			Transient				
10	16 F.	H	5	2	"			"				
11	26 F.	H	5	2	"			"				
12	22 M.	H	Always	2	"			"				
13	19 F.	H	10	2	"			Transient	Unilateral Unilateral (treated)			
14	18 F.	H	Always	2	"			"				
15	16 F.	H	"	5	"			"				
16	16 F.	H	"	0	"			"	Unilateral			
17	15 F.	H	"	3	"			"				
18	21 M.	H, A	10	3	"	Poor		"		+		
19	25 F.	H, A	Always	4	"	"		Transient			+	
20	35 F.	H, A	"	1	"	(treated) Good		"			Successful skin excision	
21	27 F.	H, A	"	8	"	"		"				
22	21 F.	H, A	"	5	"	"		"				
23	36 F.	A	"	2	"	"		Transient	Unilateral			Unilateral
24	20 F.	A	"	1	"	"		Transient	Unilateral (treated)			
25	29 M.	A	"	5	"	"		"				
26	18 F.	H, F, A	"	3	"	"		"				
27	22 F.	H, F, A	7	3	"	"		"				
28	16 F.	H, A, B	3	1	"	Poor	Poor	Transient Permanent			Successful reoperation	

H = Hands. F = Feet. A = Axilla. B = Breast.

TABLE II—Parts Affected for which Cervical Sympathectomy was Performed

No. of patients	Hands, Feet	Hands Only	Hands, Axillae	Axillae Only	Hands, Axillae, Feet	Axillae, Breasts, Hands
..	9	8	5	3	2	1

hyperhidrosis in the past 10 years (Table I). Most of them presented for operation before they were 25. In all cases the sweating was bilateral (see Table II). "Cervical" sympathectomy is done for hyperhidrosis of the hands, axillae, and breast regions, though if the axillae alone are affected simple excision of the sweaty skin after demarcation may be all that is needed. In this series 11 patients also had symptoms in the feet, but these were much milder than those in the hands. Some patients have hyperhidrosis predominantly in the feet, and for these lumbar sympathectomy can be performed; but they are not included in the present series.

No family history was noted in any of these patients. Most of them had tried some medical treatment, which had not been successful. Five patients were referred by psychiatrists to whom they had been sent because of emotional instability, though this seems to us more probably a result of aggravation by the disability than a primary causative condition.

Method

The sympathectomy is done after the manner described by Telford.⁵ To denervate the hands only the second ganglion need be removed, but if the axillae and breasts are involved the fourth ganglion should be removed too. Damage to the inferior cervical ganglion must be carefully avoided so as not to induce Horner's syndrome, which sometimes occurs immediately after operation; but if due to bruising, as it usually is, recovery will ensue after a few days. If, as seems rare, the operation is done because of facial sweating, this ganglion must be removed, accepting the syndrome and occasional nasal obstruction, complications of which the patient must be warned before operation. In the one case, mentioned above, where this was done the patient was completely satisfied and considered the operation a success.

The incision, about 10 cm long above the inner end of the clavicle, is one which heals readily and which becomes almost invisible after a short time—a consideration of importance, as most of the patients are young women.

Results

The results and complications are shown in Table II. Twenty-five of the patients had hyperhidrosis of the hands, and all had a good result on both sides. No recurrence occurred in a follow-up period of between 2 months and 10 years.

Of 11 patients with axillary hyperhidrosis 7 (63%) had a good result. The three who were operated on for axillary hyperhidrosis alone had good results and no recurrence. The four who had residual axillary hyperhidrosis had no recurrence in the hands. Two of these (Cases 18 and 19) had previously been mainly troubled by excessive sweating in the hands, and no further surgery was done. The others needed more surgery. Case 20 was cured by excising a small circle of skin from the vault of each axilla, as described by Hurley and Shelley,⁶ who suggested that the maximum concentration of eccrine sweat glands is confined to a small area there. When dry this area can be accurately delineated by powdering it with Quinizarin or 10% iodine in starch. When sweating occurs this becomes coloured and shows the skin to be excised. There is plenty of spare skin in the axillae, and the results of this operation are excellent. Case 28 had not only residual axillary but also pectoral hyperhidrosis. She was the only patient for whom a repeat operation was done, when the next distal thoracic ganglion was excised on each side, and an excellent result was achieved without recurrence.

Complications

Temporary Horner's syndrome was noted at 8 out of 56 operations, and at another it was permanent. Pneumothorax was found in 9 (16%) patients on routine chest x-ray examination, but only in two was it large enough to need temporary underwater seal drainage, and neither developed respiratory embarrassment. About half of the patients noticed excessive sweating of the hands on the third or fourth day after operation, but this subsided spontaneously. The cause of this is unknown, but should be kept in mind to reassure anxious patients and the surgeon too. Gustatory sweating occurred in one patient and responded to anticholinergic drug therapy. Phrenic nerve damage occurred on one side in one patient, but postoperative neuralgia reported by some workers was not found in this series; it occurs only after the peraxillary or posterior approach, both of which should be eschewed.

Discussion

Emotional tension is in some but not all cases the cause of hyperhidrosis, but a vicious cycle may well be set up in which the sweating produces social embarrassment and further tension. We found that the distress caused by this condition after failure of conservative measures was an important indication for operation, after which the mental health of these patients improved remarkably and rapidly.

These results emphasize the value of sympathectomy for hyperhidrosis. Resection of the second and third thoracic sympathetic ganglia always completely relieves hyperhidrosis of the hands. It has been stated that results are not permanent,⁷ but from our own experience this is not so. When an operation was done specifically for axillary hyperhidrosis—that is, resection of the fourth as well as the second and third thoracic ganglia—the results were generally good, but sometimes there was a small, easily detectable area in the apex of the axilla which could readily be excised. Several factors could be responsible for this type of sweating: firstly, there are apocrine as well as eccrine glands in the axilla; secondly, the sympathetic outflow to the axilla may not always travel exclusively through the second, third, or fourth ganglion; and, thirdly, it is technically more difficult to excise the fourth ganglion than the higher ganglia through this approach. Local excision of affected skin alone is probably to be preferred.⁸

Gustatory sweating can be a troublesome complication and

is well documented.⁹ Fortunately the one case of this in the present series responded to anticholinergic drugs. Bloor⁹ reported 29 cases (14%) in a series of 205 patients who had undergone cervical sympathectomy for other conditions as well as for hyperhidrosis.

That no family tendency to excessive sweating was found in any of these patients contradicts the findings of Gold.⁷ We disagree with Gold's statement that it is impossible to denervate the axilla without producing Horner's syndrome, as we achieved this in seven patients. Horner's syndrome follows damage to the stellate ganglion, and the sympathetic outflow to the axilla passes mainly through the fourth thoracic ganglion.

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Growing Points in Medicine

Success and Failure in Human Virus Diseases* II—Common Viruses

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Respiratory Viruses

Turning from the rare to the commonplace brings one to the respiratory viruses. These have become familiar through their recovery largely from persons with actual illnesses. Their relation to the various respiratory syndromes¹ is that none are specific for this or that clinical syndrome. Any and all of the influenza, parainfluenza, respiratory syncytial, adenoviruses, rhinoviruses, and coronaviruses may cause a sore throat, an attack of bronchitis, or a common cold. Matching viruses with syndromes has shown that each virus group is more likely to cause one than all of the other respiratory syndromes.² Thus adenoviruses are more likely to cause a febrile sore throat than a common cold or an attack of influenza.

Influenza virus B, but not usually A, may cause either a febrile cold or a general "flu-like" illness, and respiratory syncytial virus attacks first and foremost the bronchiole. Disease

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due to the latter virus is limited to a narrow age range of 2 to 18 months; yet in the newborn infection may be clinically mild.³ For this reason serum antibodies derived from the mother do not necessarily prevent infection, perhaps because being immunoglobulin G they do not appear in nasal secretion. Chanock⁴ indeed believes that union of virus in the lung with small amounts of serum antibody triggers the bronchiolar disease whereas nasal IgA antibody may be protective. There is no doubt that nasal antibody is important in conferring resistance to respiratory viruses, but adverse immunological reactions, though possibly important as the basis of illness in respiratory syncytial infection, are as yet unproved with other agents.

Another major problem of the respiratory viruses is their antigenic diversity. Over 100 rhinovirus types, more than 30 adenoviruses, an unknown number of coronaviruses, four parainfluenza viruses, and a constantly changing antigenic pattern of influenza viruses A and B furnish a veritable immunological jungle, which precludes specific prophylactic vaccines containing all components.

Enteroviruses

The large group of over 60 Coxsackie and echoviruses includes many serologically different viruses. It has become

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