Autonomic Neuroscience: Basic and Clinical 93 (2001) 91–94

AUTONOMIC NEUROSCIENCE: Basic & Clinical

www.elsevier.com/locate/autneu

Transthoracic endoscopic T-2, 3 sympathectomy for facial hyperhidrosis

Han-Jung Chen*, Kang Lu, Cheng-Loong Liang

Department of Neurosurgery, Chang Gung University and Memorial Hospital at Kaohsiung, 123, Ta-Pei Road, Niao-Sung Hsiang, Kaohsiung Hsien, Taiwan

Received 6 November 2000; received in revised form 4 June 2001; received in revised form 24 July 2001; accepted 25 July 2001

Abstract

Twenty-five patients (20 men and 5 women) with the chief complaint of facial hyperhidrosis were treated by transthoracic endoscopic T-2, 3 sympathectomy. All patients were essentially in good health except the embarrassment of facial sweating. Fifteen of them also suffered from distressing palmar hyperhidrosis. The ages ranged from 18 to 40 years (mean age 25 years).

All of them except two obtained a satisfactory improvement of facial hyperhidrosis after 3 months to 2 years of follow-up. One man demonstrated very mild ptosis in the right eye. Pre- and postoperative sympathetic skin response (SSR) revealed the absence rate from 0% to 72% with electrical stimulation ($p < 0.05$).

This study shows that T-2, 3 sympathectomy is a choice of treatment for facial hyperhidrosis and sympathetic supply to the face may at least partly be from T-2, 3 level.

Keywords: Hyperhidrosis; Sympathectomy; Sympathetic skin reflex

1. Introduction

Palmar hyperhidrosis is a disorder of excessive sweating of the palms. This disorder is common among the people in South-east China, Taiwan and Singapore (Kao et al., 19 ; Chen et al., 1994). Transthoracic endoscopic T-2, 3 sympathectomy has been proved to be an effective treatment for this disorder (Adar et al., 1977; Byrne et al., 1990; Kao, 1992). An adverse result after sympathectomy for palmar hyperhidrosis is compensatory sweating (Adar et al., 1977; Chen et al., 1994). In several studies including our experiences in about 1500 cases, compensatory sweating was found in more than 50% of patients (Chen et al., 1994, 1996). However, certain number of patients with palmar hyperhidrosis showed concomitant reduction in facial sweating without ptosis (Kao et al., 1992, 1996). This finding suggests that upper thoracic sympathetic segments including T2 and T3 may send the sympathetic fibers to the facial area.

We encountered some patients who suffered from troublesome hyperhidrosis in the heads and faces. Heavy sweating in the faces is inconvenient and embarrassing in patients' daily and social activities. We used the technique of transthoracic endoscopic T-2, 3 sympathectomy on the patients with facial hyperhidrosis. Pre- and postoperative recording of sympathetic skin response (SSR) has been used frequently for evaluating physiological change of sympathectomy (Kao et al., 1996; Lin et al., 1995). The purpose of this study is to evaluate the effect of T-2, 3 sympathectomy for the treatment of facial hyperhidrosis and relationship between perioperative SSR and changes of facial hyperhidrosis.

2. Materials and methods

2.1. Patients

Twenty-five patients with facial hyperhidrosis were treated during the past 5 years. All of them suffered from thermal facial sweating. Facial sweating was embarrassing while they worked under the room temperature above 28 °C. Of the 25 patients, 15 patients also complained of palmar hyperhidrosis. There were 20 male and 5 female patients. The age distribution was between 18 to 40 years with a mean age of 25 years. They were all in good health and no thyrotoxic symptoms. The thyroid function tests were all within normal limits.

* Corresponding author. Tel.: +886-7-7317123; fax: 886-7-7318762.
E-mail address: chenmd@ms8.hinet.net (H.-J. Chen).

1566-0702/01/$ - see front matter
PII: S1566-0702(01)00341-1

2.2. Surgical techniques

The operative procedures were performed by authors as described elsewhere (Kux, 1978; Byrne et al., 1990; Edmondson et al., 1992; Chen et al., 1994). Under single-lumen endotracheal intubation and general anesthesia, a small incision about 0.8 cm was made on the preaxillary line at the fourth intercostal space. Blood oxygen saturation and palmar skin temperature were continuously monitored. After entering the pleural cavity, a thoracoscope (Karl Storz, Tuttlingen, Germany) was inserted. The pleural cavity was inflated with carbon dioxide by an inflator (Electronic Endoflator, Karl Storz). At this time, the lung would partially collapse and the upper ribs were identified. Once the sympathetic trunk overlying the pleura close to the neck of the ribs was identified, electrocauterization of the targeted T-2, 3 ganglia was performed. When the palmar temperature showed a rise of more than 0.3 °C, it indicated an adequate denervation (Chen et al., 1994, 1996). After successful sympathectomy, the collapsed lung was inflated, the carbon dioxide in the pleural cavity was released through the endoscope. The endoscope was removed after the lung was fully expanded, and the wound was closed. The same procedure was then repeated on the contralateral side.

Infrared thermographic studies by camera capture of thermal density area on the face and limbs were performed in some patients.

2.3. Sympathetic skin response

SSR has been proven to be a useful method to examine the sympathetic sudomotor function (Levy et al., 1992; Lin et al., 1995). There was no other peripheral neuropathy such as diabetes neuropathy in these patients. SSR was performed before and 2 weeks after sympathectomy as well as in normal control group. The control group (38 peoples) including nurses, medical and paramedical personnel with good health were under study (Lin et al., 1995). Patients were in the supine position, lying in a warm, quiet and dim room. The room temperature was controlled between 21 and 25 °C. SSR was performed with surface electrodes attached to the right palm and sole as G1 and the dorsum of the right hand and foot as G2 (Shahani et al., 1984; Lin et al., 1995). The electromyographic (EMG) machine (Viking IV, Nicolet Instrument, Madison, Wisconsin, USA) with a filter setting between 0.5 and 100 Hz was used. Recordings of responses after stimulation were at the forehead, palm, thigh and sole. Both deep inspiration and electrical stimulation were used to induce SSR. Electrical stimuli delivered to the right median nerve at the wrist portion consisted of 100-μs electrical pulse at 50–150 V. For each patient, more than five deep inspirations and electrical stimuli were used. After stimulation, the responses at the forehead, palm, thigh and sole, were simultaneously recorded. The peak-to-peak amplitude of each response was measured; the largest one was selected. Under a sensitivity of 50 μV per division, the response was thought to be absent if no constant amplitude change was noted. The SSR in the frontal area (forehead) of the face before and after T-2, 3 sympathectomy were evaluated between control and patient groups.

2.4. Studies of change of facial sweating

The patients were examined twice at the out-patient clinic, at 1 and 2 weeks and then, 3 months after discharge by questionnaire. They were followed up by telephone interview or out-patient clinic in 3 months to 2 years about the results and possible complications. The questionnaire included the improvement of facial hyperhidrosis mea

Table 1
Summary of SSR in normal control people and patients before and after sympathectomy

	Control	Patient group	
		Before operation	After operation
Case number	38	25	
Age	43 ± 2.2	25 ± 2.0	
Male/female	14/24	20/5	
Absent SSR in the frontal area			
ES	0	5 (20%)*	18 (72%)+
RS	0	8 (32%)*	15 (60%)+
Mean amplitude (μV)			
RS (palm)	1131.6 ± 140.3(38)++	680.2 ± 140.6*(25)++	301.0 ± 60.2+(25)++
RS (forehead)	480.2 ± 43.0(38)++	520.0 ± 80.2(25)++	424.3 ± 60.5(25)++

ES: electrical stimulation.
RS: deep inspiration stimulation.
* Significant difference between control and patient group ($P < 0.05$, Chi-square test).
+ Significant change after surgery ($P < 0.05$, Student's t-test).
++ Number of patients.

ured a: good, fair and no improvement. Good improvement indicated handkerchief was not necessary; fair improvement indicated handkerchief was sometimes necessary for sweating.

.5 Statistical analysis

Commercially available software SPSS (Statistical ackage for the Social Sciences, version 10.0; SPSS, hicag USA) was used for statistical analysis. The numerical data are expressed as the mean ± standard error. hi-square and *t*-tests were used for comparison of results etween different groups and between pre- and postopera- ve studies.

3. Results

Bila al sympathectomy was carried out in one stage nd accomplished within 20–30 min. Fifteen patients were atisfied with good result and eight patients with fair result fter T-2, 3 sympathectomy. The facial sweating of the emainder two patients persisted. After sympathectomy, all patients demonstrated at least 0.3 °C elevation of palmar temperature. The palmar sweating improved in the 15 patients with palmar hyperhidrosis.

The were no major complications encountered. One patient had mild right eye ptosis post-operatively and resolved 3 months later. The duration of follow-up period was from 3 months to 2 years with a mean time of 9 months. Two patients revealed some recurrence of facial hyperhidrosis but they were still satisfied with the surgical results.

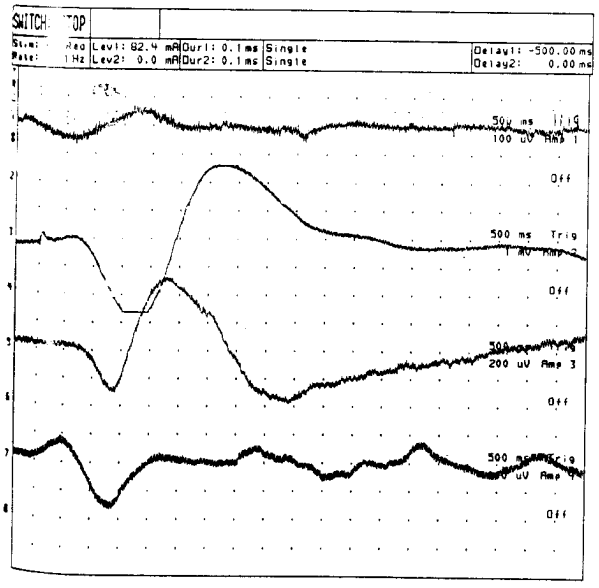

Fig. 1. ormal SSRs in the frontal area, right palm, sole and thigh (lines 2, 3, 4) on electrical stimulation are found in one patient before T-2, 3 ympathectomy.

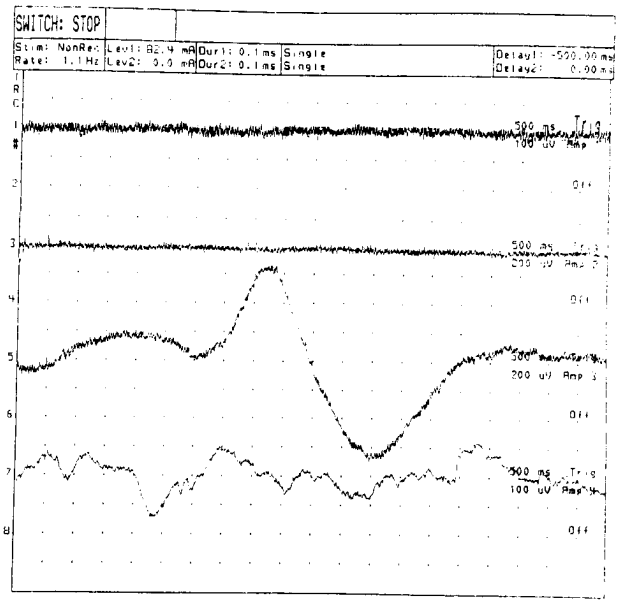

Fig. 2. After sympathectomy, absent SSRs in the frontal and right palm (lines 1 and 2) on electrical stimulation are found in the same patient. Normal SSRs in right sole and thigh (lines 3 and 4) are still present.

More than half of the treated patients (60%) suffered from some degree of post-sympathectomy compensatory sweating in the back, chest wall, abdomen and thigh. These symptoms, however, were tolerable.

In the 25 patients and 38 normal control subjects, the nerve conduction velocity of the median and common peroneal nerves were within normal limits. The results of SSR measurement before and after sympathectomy are shown in Table 1. SSR was present in every normal control people in the frontal area, palm and sole. In patient group, there were eight patients (32%) with absent SSR in the frontal area on deep inspiration and five patients (20%) with absent SSR on electrical stimulation (Fig. 1).

After sympathectomy, the absent SSR in the frontal area on electric stimulation was found in 18 patients (72%); on deep inspiration, absent SSR was found in 15 patients (60%) (Fig. 2). The rate of absent SSR increased significantly after T-2, 3 sympathectomy ($p < 0.05$).

4. Discussion

Facial hyperhidrosis may be an abnormal physiological state of excessive sweating in the head and face. The cause, like that of palmar hyperhidrosis, is not clear. The sudomotor activities may accelerate sweating by stimulating the sweat gland and disturb the daily activities of patients. There is no effective therapy reported in the literature (Kao et al., 1996).

The preganglionic fibers that innervate the head, neck, and upper extremities may be from T-1 to T-5 level. These fibers ascend and synapse in the upper thoracic sympathetic ganglia and cervical ganglia (Ray et al., 1943). The

T-2, 3 sympathectomy is considered to be a key point for the surgical treatment of palmar hyperhidrosis. The anatomy of the sympathetic outflow from the T-2, 3 ganglia is not very clear in the topographic studies (Ash et al., 1986). The clinical experiences that T-2, 3 sympathectomy can relieve palmar hyperhidrosis and concomitantly result in a diminution of facial sweating (Kao et al., 1996; Andrews and Rennie, 1997) reveal the T-2, 3 preganglionic fibers to the palms and also to the face (Kao et al., 1996).

We have recorded the skin temperature change in the palms and sympathetic skin response before and 2 weeks after surgery. All patients demonstrated temperature elevation of the palms after T-2, 3 sympathectomy. This supports that the sudomotor and vasomotor fibers in the upper limbs are very associated. The absent rate of frontal SSR before sympathectomy is found to be significantly higher in patient group (20% with electrical stimulation and 32% with deep inspiration stimulation). This phenomenon can also be observed in the patients with palmar hyperhidrosis (Lin et al., 1995). The reason is not very clear, probably due to autonomic regulatory dysfunction (Chen et al., 1994; Lin et al., 1995). The absent rates of sympathetic skin response in the frontal area before and after sympathectomy demonstrated significant increase ($p < 0.05$). The discrepancy between the increase in absent SSR in the frontal area and the lack of significant change in the amplitude of the frontal SSR is also noted. This study also suggests the T-2, 3 preganglionic fibers to the palms and also to the face.

During the T-2, 3 sympathectomy, we always checked the patients' pupils. The electrocoagulation to the T-2 sympathetic ganglion induces a slight dilatation of the ipsilateral pupil in some patients. This phenomenon may be the result of the electrical stimulation on the ganglia, which send a few fibers to the cervical ganglia or the eye (Ray et al., 1943; Kao et al., 1996). This probably gives the explanation of one patient in our series who showed the postoperative complication of transient right eye ptosis.

In this study, we used the transthoracic endoscopic T-2, 3 sympathectomy to treat the facial sweating. The result is satisfactory. The absent rate of sympathetic skin response in the frontal area shows a significant difference before and after sympathectomy. There is a correlation between the change of the facial sweating and perioperative sympathetic skin response in the frontal area. The results demonstrate that T-2, 3 sympathectomy may be a choice of treatment for facial hyperhidrosis and sympathetic supply to the face may at least partly be from the T-2, 3 level.

References

Adar, R., Kurchin, A., Zweig, A., Mozes, M., 1977. Palmar hyperhidrosis and its surgical treatment. Ann. Surg. 186, 34–41.

Andrews, B.T., Rennie, J.A., 1997. Predicting changes in the distribution of sweating following thoracoscopic sympathectomy. Br. J. Surg. 84, 1702–1704.

Ash, C.J., Shealy, C.N., Young, P.A., Van Beaumont, W., 1986. Thermography and the sensory dermatome. Skeletal Radiol. 15, 40–46.

Byrne, J., Walsh, T.N., Hederman, W.P., 1990. Endoscopic transthoracic electrocautery of the sympathetic chain for palmar and axillary hyperhidrosis. Br. J. Surg. 77, 1046–1049.

Chou, H.J., Shih, T.Y., Fung, S.T., 1994. Transthoracic endoscopic sympathectomy in the treatment of palmar hyperhidrosis. Arch. Surg. 129, 630–633.

Chen, H.J., Shih, T.Y., Cheng, M.H., 1996. Transthoracic endoscopic sympathectomy for primary hyperhidrosis in children. Pediatr. Surg. Int. 11, 119–122.

Edmondson, R.A., Banerjel, A.K., Rennie, J.A., 1992. Endoscopic transthoracic sympathectomy in the treatment of hyperhidrosis. Ann. Surg. 215, 289–293.

Kao, M.C., 1992. Video endoscopic sympathectomy using a fiberoptic CO_2 laser to treat palmar hyperhidrosis. Neurosurgery 30, 131–135.

Kao, M.C., Lin, J.Y., Chen, Y.L., Hsieh, C.S., Tsai, J.C., 1996. Endoscopic sympathectomy treatment for craniofacial hyperhidrosis. Arch. Surg. 131, 1091–1094.

Kux, M., 1978. Thoracic endoscopic sympathectomy in palmar and axillary hyperhidrosis. Arch. Surg. 113, 264–266.

Levy, D.M., Reid, G., Rowley, D.A., Abraham, R.R., 1992. Quantitative measures of sympathetic skin response in diabetes: relation to sudomotor and neurological function. J. Neurol. Neurosurg. Psychiatry 55, 902–908.

Lin, T.K., Chee, E.C.Y., Chen, H.J., Cheng, M.H., 1995. Abnormal sympathetic skin response in patients with palmar hyperhidrosis. Muscle Nerve 18, 917–919.

Ray, B.S., Hinsey, J.S., Geohegan, W.A., 1943. Observations on the distribution of the sympathetic nerves to the pupil and upper extremity as determined by stimulation of the anterior roots in man. Ann. Surg. 118, 647–655.

Shahani, B.T., Halperin, J.J., Boulu, P., Khalil, N., 1984. Sympathetic skin response—a method of assessing unmyelinated axon dysfunction in peripheral neuropathies. J. Neurol. Neurosurg. Psychiatry 47, 536–542.