Autonomic Activity Change of Hyperhidrosis Patients After Endoscopic Laser Sympathectomy

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Abstract — Two hundreds and fifty palmar hyperhidrosis patients have been successfully treated with the author's (M.C. Kao) new technique "Video endoscopic laser sympathectomy" over the last two years. The preoperative and postoperative palmar skin perfusion and temperature was measured in 39 patients in order to evaluate the therapeutic effect of this method. Sympathetic skin response (SSR) was also studied in 20 patients.

Both palmar perfusion and temperature were significantly increased after the operation: perfusion of right hand from 32.2 perfusion unit (PU) rose to 54.0 PU, left hand from 27.3 PU to 50.1 PU; temperature of right hand from 29.4°C to 32.4°C, left hand from 29.2°C to 31.4°C. An obvious decrement of amplitude ratio of palmar SSR was, meanwhile, also found after the sympathectomy. These postoperative autonomic activity changes have correlated well with the satisfactory relief of excessive sweating of hands which originally wet and cold became dry and warm. Extirpation of T2 segment was found here to be sufficient enough in relieving palmar hyperhidrosis with the least complication and without substantial increase of the risk of recurrence. This extent of sympathectomy has proven optimal for palmar hyperhidrosis.

Key words: Vasomotor and sudomotor activity, Hyperhidrosis, Endoscopic laser sympathectomy
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Palmar hyperhidrosis (PH) is common in Orientals coming from subtropical areas. The young population between 15 to 30 years in Taiwan has been surveyed here. Approximately one in 300 persons were found to have suffered from a significant degree of PH. A family tendency of 12.5%, meanwhile, existed in the survey of 100 PH patients' family history. The etiology of PH has still remained unknown. It often causes serious psychological embarrassment and occupational handicaps. Many kinds of treatment are currently in practice, but none has proven entirely satisfactory. The effects of medical or local treatment are usually temporary[1-3]. The percutaneous electrocoagulation technique fails in extirpating the sympathetic ganglion accurately because the sympathetic trunk is radiologically not demonstrable and has many anatomical variations[4-7]. A large skin incision and resection of the ribs are required[8-9], even though the sympathetic ganglion can be precisely excised through open surgery. Endoscopic techniques of sympathectomy previously developed by Kux[10] and Weale[11] were not well accepted[12] due to the operation field not being clearly magnified. Electrophysiological tests[13,14] were also not applied by them in accurately locating the target sympathetic segment. A convenient tool, fiber optic laser was also not realized by them in extirpating the target without the need of undue dissection.

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A new therapeutic technique has recently been developed by us through combining differential ventilation anesthesia[15, 16], an operating thoracoscope set, a video endoscopic system, a laser Doppler flowmeter and a fiber optic laser unit. The proper sympathetic segment was able to be identified and located in this method with the aid of electrophysiologic test for precise laser extirpation and in achieving a satisfactory result[13, 17, 18]. The detailed techniques had been previously described in the report of Kao[17,18]. The preoperative and postoperative palmar skin perfusion, palmar skin temperature and sympathetic skin response (SSR)[19, 20, 21] had been measured in order to evaluate the therapeutic effect of this method. Vasomotor and sudomotor activities after this endoscopic laser sympathectomy are reported here in this present study. Their clinical significance is also to be discussed.

MATERIALS AND METHODS

Two hundreds and fifty PH patients have been successfully treated by us during the last two years via the technique of video endoscopic laser sympathectomy without any major complications[18]. All the patients attained a satisfactory relief of PH except for 8 patients: 3 patients with incomplete relief due to a vague TV image displayed from poor video quality used in the early period, other 5 patients due to multiple apical lung adhesions with poor exposure of the sympathetic trunk.

From the series of those PH patients with satisfactory result, 39 of them were randomly selected for measuring their palmar skin microcirculation and skin temperature just before operation and postoperatively within 2 weeks. The measurement was performed in a quiet room with a constant room temperature around 20°C. The palmar skin perfusion was measured with a laser Doppler flowmeter (PeriFlux RF 3 type, Perimed of Sweden). The palmar skin temperature was measured with an ordinary thermometer of good sensitivity. The age of these patients ranged from 10 to 58 years. There were 17 males and 22 females. All obtained satisfactory relief of their palmar hyperhidrosis: their hands became warm and dry after operation.

20 patients from the above series were, meanwhile, studied regarding their sudomotor activity with SSR through implementing quantitative electrical stimulation as a stressful condition for inducing the change of sudomotor activity[19,20,21]. The situation of the patients and the techniques of performing SSR were previously described by Tsai et al[21]. The effect of endoscopic laser sympathectomy was estimated through a comparison of the amplitude ratio of palmar SSR before and after operation. The change of amplitude of pedal SSR of the same person was used as the control.

RESULTS

The mean perfusion units (PU) and skin temperature in 39 patients before and after sympathectomy are shown in Table 1. The preoperative mean PU of palms were 32.2 PU (right) and 27.3 PU (left) and the postoperative were 54.0 PU (right) and 50.1 PU (left). A significant increase in palmar microcirculation of both hands existed after operation, indicating that a definite sympathetic denervation was achieved (Figure. 1). The preoperative mean temperature of

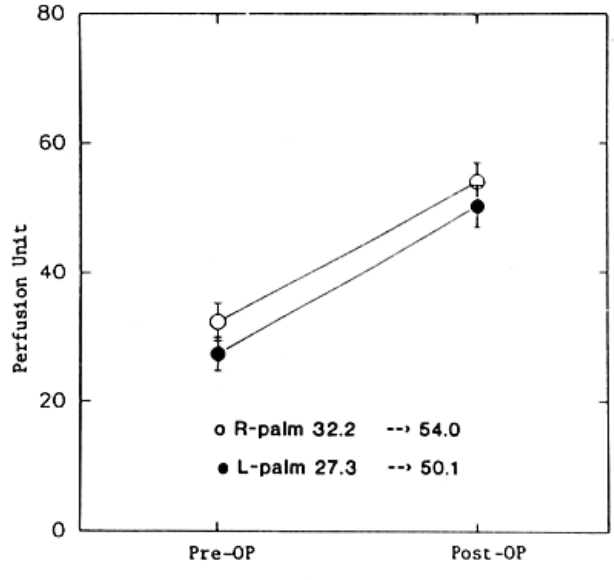

FIG. 1. The preop. and postop. palmar skin perfusion of both hands.

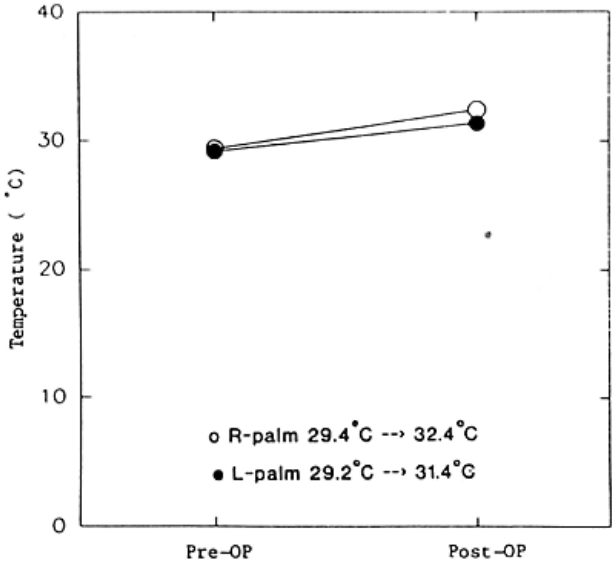

FIG. 2. The preop. and postop. palmar skin temperature of both hands.

palms were 29.4°C (right) and 29.2°C (left) and the postoperative were 32.4°C (right) and 31.4°C (left). The palmar temperature also significantly increased after sympathectomy (Figure. 2). The postoperative increase of palmar skin microcirculation and temperature clearly resulted from the sympathetic denervation and correlated well with the patient's satisfaction that their cold and wet hands became warm and dry after operation.

Findings of SSR study before and after surgery in 20 PH patients are shown in Table 2.[21] The reflex latency recorded before sympathectomy was 1.28 ± 0.16 second (palm) and 1.85 ± 0.32 second (sole). The amplitude was 1.94 ± 1.29 mV (palm) and 1.33 ± 1.06 mV (sole). The latency recorded after sympathetic denervation was 1.14 ± 0.14 sec (palm) and 1.81 ± 0.24 sec (sole). The amplitude was 0.09 ± 0.20 mV (palm) and 0.96 ± 0.83 mV (sole). A significant decrement of the amplitude ratio of palmar SSR occurred after sympathectomy through a comparison with that of pedal SSR. No significant difference was found for latency ratio between that of palm and sole[21]. Of these patients, their postoperative palmar skin temperature also significantly increased (elevation 4.68 ± 2.18°C).

Table 1. *The palmar skin perfusion and temperature before and after sympathectomy in 39 patients with palmar hyperhidrosis*

Right hand	Left hand	
Perfusion unit		
Before op.	32.2 ± 2.93	27.3 ± 2.56
After op.	54.0 ± 2.98	50.2 ± 3.28
Skin temperature (°C)		
Before op.	29.4 ± 0.58	29.2 ± 0.59
After op.	32.4 ± 0.53	31.4 ± 0.57

Table 2. *Latency and amplitude changes of skin response in 20 patients with palmar hyperhidrosis*

	palm	sole
Reflex latency (sec)		
Before op.	1.28 ± 0.16	1.85 ± 0.32
After op.	1.14 ± 0.14	1.81 ± 0.24
Reflex amplitude (mv)		
Before op.	1.94 ± 1.29	1.33 ± 1.06
After op.	0.09 ± 0.20	0.96 ± 0.83

DISCUSSION AND CONCLUSION

Removal of thoracic T2-3 sympathetic ganglia has been generally agreed to be essential for curing of PH[9,22,23]. T2 segment of the sympathetic trunk (the T2 ganglion and its neighbouring trunk)[13,17,18] can be accurately extirpated through our video endoscopic technique in attaining an adequate relief of PH. The vasomotor and sudomotor activity of the palms is studied here before and after sympathectomy through a measurement of the palmar skin microcirculation, temperature and SSR. This is done in order to confirm the therapeutic effect of this method. Starch-iodine test[9] has been used in examining the sweating activity. It is, however, time-consuming and can't be quantitatively documented. Measurement of palmar skin perfusion and temperature is a good indicator of the

sympathetic activity, even though it does not directly reflect the sudomotor function. A significant increase in palmar skin perfusion and temperature immediately occurred in this observed study after T2 sympathectomy. It was well correlated with the patient's clinical appreciation and their unpleasantly wet hands became warm and dry.

Direct recordings of SSR is, meanwhile, a useful way of recording a quantitative measurement and evaluation of the sweating activity in an artificially-created stress condition. The preoperative SSR amplitudes have shown a wide variation in this study. The changes of SSR amplitudes have, therefore, not been good indicators of sympathetic denervation. The palmar amplitude ratio, which was obtained through a comparison of the amplitude ratio (postoperative amplitude to preoperative amplitude) of palmar SSR with that of pedal SSR in the same individual, however, showed a significant degree of decrement. This ratio seems to be a good electrophysiological guidance for evaluation of the sympathectomy effect of hyperhidrosis. The latency changes of palm and sole after sympathectomy was, on the other hand, not obvious. The latency ratio (preoperative latency to postoperative latency) of palm was also 0.93 + 0.08 and of sole 0.98 ± 0.15[21]. No significant difference existed between them, so that it could not be considered as being a sensitive indicator for sympathetic denervation.

In this short-term follow-up study, the postoperative increase of palmar skin perfusion and temperature was well correlated with the postoperative decrement of amplitude ratio of palmar SSR. Up to the present time, based on the above study and our clinical observation (unpublished data), that extirpation of T2 segment (T2 ganglion and its adjacent trunk) with video endoscopic laser technique is tentatively concluded here to be the optimal extent of sympathectomy for palmar hyperhidrosis. This extent of denervation would be sufficient enough in relieving PH with less complication of compensatory hyperhidrosis[24, 25] and almost no increaseed risk of recurrence. A long-term follow-up of the palmar vasomotor and sudomotor activity in correlating with the clinical results in the patients treated with this new technique will be carried out in due time.

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