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Use of perioperative thermal camera for the assessment of sympathectomy effectiveness

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ABSTRACT

Objectives: Primary Hyperhidrosis (HH) is the excessive sweating condition in one or more parts of the body. The definitive treatment method is surgical. The most commonly applied surgical method is endoscopic thoracic sympathectomy (ETS). We aimed to investigate the effectiveness of patients with hyperhidrosis by making temperature measurements.

Methods: We analyzed the findings of 30 patients who were diagnosed with HH between January 1, 2019 and November 1, 2022 in Kahramanmaraş Sütçü İmam University Thoracic Surgery Clinic. Preoperative, intraoperative and postoperative hand temperatures of the patients who underwent bilateral endoscopic thoracic sympathectomy were examined by measuring hand temperatures with a thermal camera.

Results: After the evaluation of the examination, it was revealed that there was an increase in the hand temperature measurement values before sympathectomy and after the sympathectomy operation.

Conclusions: We believe that endoscopic thoracic sympathectomy performed by measuring temperature with a thermal camera will increase the comfort and safety of the surgery both on the part of the physician and the patient.

Keywords: Sympathectomy, sweating, thoracal surgery, thermal camera

Primary hyperhidrosis is involuntary excessive sweating condition in one or more parts of the body in case of psychological situations, under stress, and in some seasons. Sweating does not occur during sleeping at nights. The incidence of this condition varies between 1% and 3% in the society [1, 2]. It is observed equally in both sexes, regardless of gender. It has been reported that the incidence of Primary Hyperhidrosis increases in adolescence and young adulthood [2]. It tends to start in early childhood, its severity increases at puberty, and its incidence decreases gradually in elder ages [3, 4].

Although there are different medical and surgical options in its treatment, medical treatment provides temporary relief in many patients. The definitive treatment method for hyperhidrosis is surgical. Efforts to minimize surgical trauma and facilitate a faster healing process have led to the emergence of minimally invasive surgery [5]. With the developing techniques, the most applied surgical treatment is endoscopic thoracic sympathectomy [6].

In this article, we aimed to share the thermal camera measurement results conducted before and after sympathectomy in patients to whom we applied ETS in the light of the literature.

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METHODS

This study was conducted in accordance with the Declaration of Helsinki. Before participating in the study, ethical approval was obtained from the Non-Invasive Clinical Research Ethics Committee of our University on 06.03.2019 (Session no: 2019/5, Decision no: 4).

Design

The findings of patients to whom ETS was applied with the diagnosis of primary hyperhidrosis between 01.05.2018 and 01.10.2022 in Thoracic Surgery Clinic of our University were analyzed. Posteroanterior (PA) and lateral chest radiography and electrocardiography (ECG) were routinely taken for all patients before the operation. After the patient was intubated, the measurements of the patient were made with a thermal temperature camera (FLIR TG 165-x Oregon, U.S.) before and after the sympathectomy is performed.

Surgical procedure

The patients were operated in the semi-sitting position in a way that both arms were in abduction at 90 degrees. The operation was performed under general anesthesia using a double-lumen endotracheal tube. After one lung ventilation, the thoracic cavity was entered with blunt dissection after 1.5 cm skin incision was applied from the mid-axillary line. A port was placed in the hemithorax for which the operation was made. According to the patient's complaint, if it is facial HH, the 2nd sympathetic nerve was resected by being burned with hook electrocautery, and if it is palmar HH, 3rd and 4th sympathetic ganglions were resected by being burned with hook electrocautery, and if it is axillary HH, the 4th and 5th sympathetic ganglions were resected by being burned with hook electrocautery. After applying sympathectomy, it was aimed to prevent recurrence development due to alternative sympathetic nerve connections such as the kuntz nerve, and the inner surface of the rib at the operation level was drawn with a cautery about 2-3 cm from the sympathetic nerve level to the lateral. Into the pleural-thoracic cavity and after placing the other end in a container filled with saline, the lung was ventilated and it was continued until the air outlet ceased. After the air outlet ceased, the nelaton catheter was withdrawn and the hemithorax inlet was sutured. The same process was applied to the other hemithorax. The operation was ended without placing a chest tube. Patients were evaluated by taking postoperative chest X-ray in the operating room, and they were taken to the hospital service.

Statistical Analysis

The data obtained were analyzed using Graphpad Prism version 5 (GraphPad Software Inc., San Diego, CA, USA). After analysis of variance, Student's t-test was performed. Data were presented as mean ± standard error. P-values <0.05 were considered significant.

RESULTS

Fifteen of 30 patients were male, and 15 of them were female. The mean age of patients operated for palmar HH was 21. 8 (range: 14-33) years, 2 of them were operated for axillary HH, and 20 of them were operated for axillary and palmar HH. All patients except one patient underwent bilateral sympathectomy, and totally 58 ETSs were applied in the same session.

Average operation time was 20 minutes. The hospital stay of the patients was 0.93 days. All patients except one were taken to the thoracic surgery service without a chest tube. While 5 patients were discharged on the same day, 24 patients were discharged on the next day after the PA chest X-ray. A 30-year-old male patient was discharged on the 3rd day. No mortality was observed in the patients. While the mean preoperative hand temperature measurement values were 28.59±2.304 ºC for the right hand before the operation, the temperature value for the left hand was measured to be 28.61±2.246 ºC. After intubation and before applying sympathectomy (perioperative), the mean hand temperature measurements were 28.472±0.287 ºC for the right hand and it was measured to be 28.41±2.267 ºC for the left hand. After the sympathectomy operation (postoperative), while the mean temperature of the right hand was measured to be 29.50±2.519 ºC, the mean temperature of the left hand was 29.51±2.525 ºC.

The female body mass index was calculated to be 22.39±2.74 (range: 19.96-29.76) kg/m^2 and body mass index of the males was calculated to be 23.95±2.67 (range: 20.52-31.40) kg/m^2. There was no statistical difference between the two groups. In a patient with a high body mass index (31.97 kg/m^2), the operation could not be performed because the sympathetic nerve

could not be seen. Hand temperature measurements made throughout the entire intervention are shown in Table 1.

Although the postoperative temperature measurements were higher than preoperative measurements, no statistical difference was found between them (P>0.05). In addition, no statistical significance was found between the right- and left-hand temperature measurements of the patients (P>0.05) (Table 1).

Table 1. Hand temperature measurement values

n=30	Preoperative right hand (ºC)	Preoperative left hand (ºC)	Perioperative right hand (ºC)	Perioperative left hand (ºC)	Postoperative right hand (ºC)	Postoperative left hand (ºC)
1.	27.2	27.3	27.0	27.1	27.7	27.8
2.	25.2	25.3	25.1	25.2	25.9	26
3.	29.3	29.5	29.0	29.1	30.1	30.1
4.	32.3	32.3	32.1	32.0	33.5	33.5
5.	32.9	32.7	32.9	32.6	34.2	34.5
6.	29.2	29.1	29.1	29.0	29.7	29.7
7.	25.8	25.9	25.4	25.6	26.6	26.6
8.	30.1	30.2	30.0	29.9	31.9	31.9
9.	32.3	32.1	32.2	32.0	33.5	33.4
10.	32.9	32.7	32.7	32.6	34.2	34.2
11.	29.2	29.3	29.0	29.1	29.7	29.7
12.	25.8	25.8	25.8	25.7	26.6	26.6
13.	31.4	31.2	31.3	30.9	32.1	32.2
14.	28.4	28.4	28.3	28.4	29.2	29.2
15.	27.3	27.4	27.1	27.2	28.0	27.9
16.	30.2	30.3	30.0	30.1	31.8	31.7
17.	25.7	25.9	25.7	25.6	26.4	26.4
18.	30.4	30.4	30.1	30.0	30.9	30.8
19.	26.3	26.4	26.3	26.1	26.9	26.9
20.	29.4	29.4	29.3	29.1	30.3	30.3
21.	25.9	25.9	25.9	25.8	26.8	26.8
22.	28.2	28.2	28.1	28.0	30.1	30.2
23.	30.3	30.3	30.1	30.1	31.4	31.5
24.	25.9	25.8	25.9	25.8	26.5	26.4
25.	26.4	26.5	26.4	26.3	27.2	27.2
26.	27.1	27.2	27.0	27.0	27.9	27.8
27.	26.8	26.8	26.7	26.0	27.6	27.7
28.	27.3	27.4	27.3	27.2	27.9	27.8
29.	30.1	30.0	30.0	30.0	31.2	31.3
30.	29.7	29.5	29.6	29.6	29.6	29.7
Mean±SD	28.59±2.304	28.61±2.246	28.472±0.287	28.41±2.267	29.50±2.519	29.51±2.525

SD=standard deviation

DISCUSSION

Thermoregulation, and thus sweat production, is regulated by the preoptic region of the anterior hypothalamus, cerebral cortical structures, and the sympathetic nervous system. Thermal receptors are found in the internal organs and hypothalamus in the body as well as in all parts of the body such as brain stem, spinal cord, and skin. Afferent nerve fibers carry signals to the hypothalamus via pathways in the lateral part of the medullaspinalis. Efferent sympathetic sudomotor pathways for thermoregulation pass from the cerebral cortex to the hypothalamus, from the hypothalamus to the medulla oblongata, and proceed along the medulla spinalis cornu lateralis. From here, it passes into the intermediolateral cell nuclei of the paravertebral sympathetic ganglion of the medulla spinalis, and then ends with the stimulation of unmyelinated, postganglionic sympathetic class C nerve fibers and postsynaptic muscarinic receptors of the eccrine sweat gland [7, 8].

Sweating is a complex and physiological process. Both emotional sweating and thermoregulatory sweating are triggered by sympathetic cholinergic nerves. Emotional sweating is regulated by the limbic system Cingulate cortex's anterior and the hypothalamus. The parts that control emotional sweating are more commonly the armpits, palms, soles, forehead, and scalp. Existence of excess eccrine sweat glands, especially in the hands, feet and armpits, as a result of stimuli originating from the central nervous system is called hyperhidrosis. Eccrine sweat glands are believed to be responsible for primary HH. Eccrine sweat glands are the only sweat glands found in the palms [8, 9].

In our study, the affected parts of patients with HH were palm and axilla. The rates of coming to the hospital of female and male patients were equal in our study, and the patients came to our clinic most commonly due to palmar HH (28 patients) (93%).

Hyperhidrosis not only makes the life of the individual difficult, but also has negative effects on the social life of the individual. In its treatment; drugs, botox application and iontophoresis, and surgical treatment methods are used. Surgical treatment is the definitive treatment method. Today, the most frequently applied surgical method is ETS [6]. In our study, ETS was applied to 30 patients who came to our clinic with the complaint of HH. However, only for 1 patient, the desired result was not obtained.

In the classical management of anesthesia in minor endoscopic surgery procedures, a double-lumen tube (DLT) or endobronchial blocker (EBB) is used as an airway device to provide single-lung ventilation. Although ETS, which has a high efficiency and chance of success, in one lung ventilation with DLT and EBB; damage to tracheobronchial structures, bleeding, malposition of the tube, dependent and non-dependent lung barotrauma, volutrauma, atelectotrauma and bio-

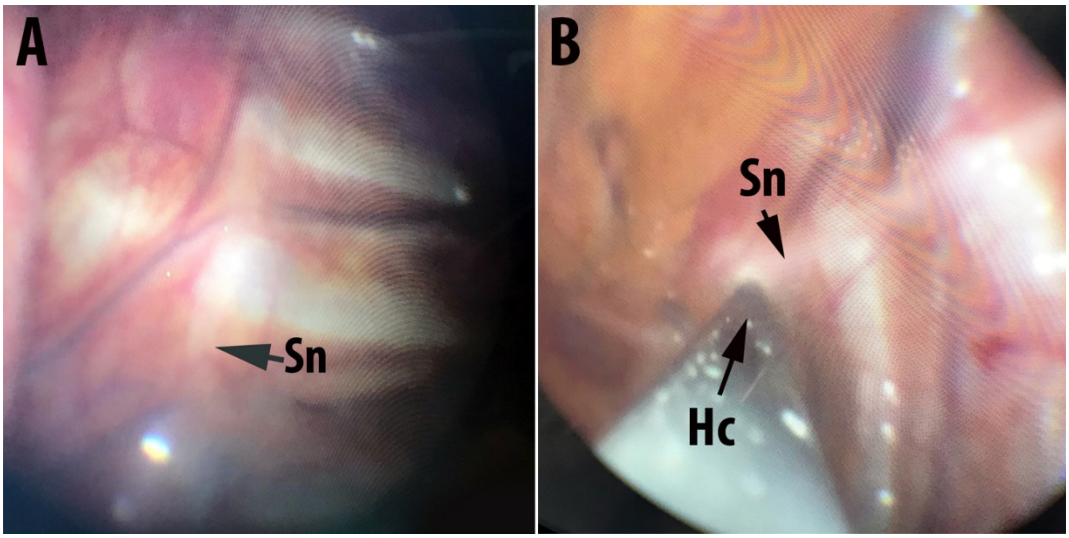

Fig. 1. (A) Image of the Sympathetic Nerve on the Chest Wall, (B) The moment of cauterization of the sympathetic nerve (Sn=Sympathetic nerve, Hc=Hook Electrocautary).

trauma and postoperative respiratory complications may occur [10-13]. No trauma related to intubation was seen in our study. All patients were extubated and taken to the thoracic surgery service without any problem.

The fact that ETS is a minimally invasive method has made it a standard, well-tolerated option in the treatment of the disease [14, 15]. ETS surgery, which was initially performed with the use of more than one port, has been applied as a single port in recent years, with the popularity of the single port approach in other surgical fields. In our clinic, sympathectomy, which was initially performed by using double port, has recently started to be performed by using the single port, and the single port was applied to all patients in this study.

In ETS, there are different applications in terms of the type of blockage of the sympathetic nerve as well as the way of entering the thorax [16, 17]. Despite these differences, in a study conducted; it was found that there was no significant difference between applications such as burning, cutting and clipping in terms of postoperative complications and patient satisfaction [18]. The thoracic sympathetic chain extends below the parietal pleura on both sides of the spine and consists of 10-12 ganglions. ETS is performed at certain levels by interrupting this ganglion and the pathways between them [16, 17]. In our clinic, the operations were completed by interrupting the sympathetic ganglion using ETS hook electrocautery (Fig. 1). Although there are debates and conflicting opinions about the best level for sympathetic chain resection, it is recommended to remove the T3 or T3-4 ganglion for palm sweating, T4 for armpit sweating, and T2 ganglion for facial sweating [19]. In our study, ablation was applied by making operation to T3 and T4 ganglions for palmar HH, and to T4-T5 ganglions for axillary HH.

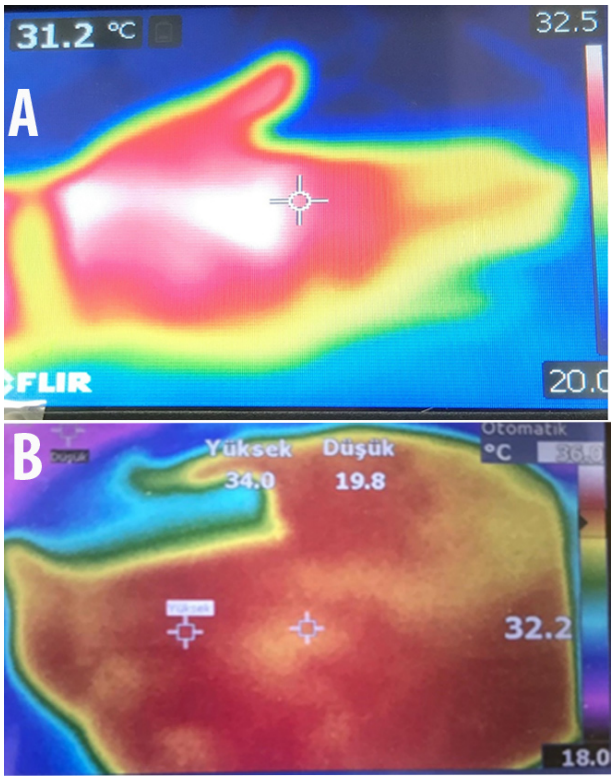

Fig. 2. (A) Images of hand temperature measurement before sympathectomy and (B) after sympathectomy.

Preferring the thoracoscopic approach instead of traditional surgery and avoiding additional port incision cause less muscle tissue and intercostal nerve damage. This helps to feel less postoperative pain, increase patient satisfaction, and help the patient to return to social life more quickly [20, 21]. In particular, hand sweating is a condition that negatively affects social life, but can be treated with low morbidity and high success rates. Success rates are reported to be between 90-100% for hand sweating [22-24]. In our study, it was seen that the satisfaction rate in patient feedback information was 96%. We think that the fact that patients return to social and business life early by being discharged on the next day or on the same day is effective in the high patient satisfaction rates.

Before ETS surgery, patients should be informed in detail about possible complications and their consent should be obtained [25].

The most common complication of ETS is compensatory sweating, and its incidence varies between 3% and 98% among all different surgical approaches in the literature [2, 26]. However, it was determined that the complaints of all patients disappeared 6 months after the operation. All patients had a low body mass index except for 1 patient we operated. Sympathectomy could not be performed in the patient who was not weak, since the adipose tissue did not allow us to see the sympathetic nerve.

In a study, an increase in palm temperature was observed, which was detected by cutting the sympathetic chain during performing the operation [27]. In parallel with this study, a significant increase in hand temperature values was observed after sympathectomy in the study we conducted in our clinic (Fig. 2).

CONCLUSION

We believe that endoscopic sympathectomy, which is a practical and reliable method with a short discharge time and returning to normal life on the same day as well as being more cautious in patients with a high body mass index and performing the operation by measuring the temperature with a thermal camera will increase even more the patient satisfaction and the reliability as well as the prevalence of this method in addition to increasing the comfort of the physician in surgery.

Authors' Contribution

Study Conception: AA; Study Design: AY; Supervision: AA; Funding: AY; Materials: AA; Data Collection and/or Processing: AA, AY; Statistical Analysis and/or Data Interpretation: AA; Literature Review: AA; Manuscript Preparation: AA and Critical Review: AA.

Conflict of interest

The authors disclosed no conflict of interest during the preparation or publication of this manuscript.

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