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Research Article

Is Palmar Temperature Change a Predictor of Operative Success in Patients Undergoing Sympathectomy for Idiopathic Hyperhidrosis?

İdiyopatik Hiperhidrozis Nedeniyle Sempatektomi Uygulanan Hastalarda Tedavi Etkinliğini Belirlemede Palmar Isı Değişimi bir belirteç midir?

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Abstract

Endoscopic thoracic sympathectomy (ETS) has been shown to be an effective treatment for idiopathic hyperhidrosis, particularly in cases of excessive sweating in the palmar and axillary regions. The present study observed peroperative palmar temperature change and made a comparison between postoperative sweating complaints. A total of 30 patients diagnosed with idiopathic hyperhidrosis underwent videothoracoscopic sympathectomy and during operation changes in palmar temperature were recorded. The records were then compared with the satisfaction questionnaire that had been administered to the patients. Subsequent to the sympathectomy procedure, measurements were made at five-minute intervals, with the values being recorded at the conclusion of 15 minutes. The mean temperature increase was 1.3°C for the right hand and 1.6°C for the left hand. The measured temperature increases were found to be statistically significant (p=0.01). When the temperature increases were compared according to T3 and T3+T4 sympathectomy level, there was no significant difference in temperature increases between the groups. Furthermore, a significant proportion of patients expressed satisfaction with both the operation itself and the subsequent recovery period, with 77% rating their experience as either 'good' or 'excellent'. The success and efficiency of the sympathectomy procedure can be demonstrated by palmar temperature monitoring during the perioperative period. This provides the surgeon with a valuable indication of the efficacy of the procedure during the operation, with the potential to mitigate postoperative complications by circumventing additional tissue dissection, particularly in cases involving patients with pleural adhesions or variations, such as the azygos lobe, that complicate the procedure.

Keywords: Compensatory Sweating, Endoscopic Thoracic, Hyperhidrosis, Palmar Temperature Monitoring, Palmoplantar Sweating, Sympathectomy.

Özet

İdiopatik hiperhidrozis tedavisinde Endoskopik torakal sempatektomi (ETS) özellikle palmar ve aksiller aşırı terleme sorununa yüksek oranda fayda sağlayan bir yöntemdir. Bu çalışmada peroperatuar palmar ısı değişimi gözlenerek, postoperatif dönemdeki terleme şikayetleri karşılaştırılmıştır. İdiopatik hiperhidrozis tanılı 30 hastaya videotorakoskopik sempatektomi operasyonu uygulanarak, ameliyat süresince palmar ısı değişimleri kayıt altına alındı. Kayıtlar, hastalara uygulanan memnuniyet anketi ile karşılaştırıldı. Sempatektomi işlemi sonrası 5'er dakikalık aralıklarla ölçümler yapılarak 15 dakika sonunda değerler kaydedildi. Sağ el için ortalama ısı artışı 1.3°C iken sol el için 1.6 °C idi. Ölçülen ısı artışlarının istatistiksel olarak anlamlı olduğu belirlendi (p=0.01). T3 ve T3+T4 sempatektomi seviyesine göre ısı artışları karşılaştırıldığında gruplar arasında ısı artışlarında anlamlı bir fark olmadığı görüldü. Hastaların %77'si operasyonu ve sonrasındaki dönemi "iyi" veya "çok iyi" olarak değerlendirdi. Peroperatif süreçte palmar sıcaklık takibi ile sempatektomi işleminin başarısı ve etkinliği gösterilebilir. Bu, operasyon sırasında cerraha yaptığı işlemin başarısı hakkında fikir vermekle beraber, özellikle plevral adezyonları olan veya azigos lobu gibi işlemi zorlaştıran varyasyonlar nedeniyle ortaya çıkabilecek zorlukların önüne geçerek fazladan doku diseksiyonunu önlemek suretiyle postoperatif komplikasyonların azalmasını sağlayabilir.

Anahtar Kelimeler: Kompensatuar Terleme, Endoskopik Torakal, Hiperhidrozis, Palmar Isı Takibi, Palmoplantar Terleme, Sempatektomi.

Introduction

Hyperhidrosis is the production of more than the required amount of sweat due to hyperactivity of eccrine sweat glands to keep the body temperature at normal level (1). Idiopathic hyperhidrosis is the most common type of hyperhidrosis encountered clinically. It occurs as a result of overactive eccrine sweat glands without any underlying disease. It is most commonly observed in the palmoplantar region; axilla and cervicofacial sweating are other common sites (2). It is a non-progressive but uncomfortable condition which limits the daily activities of the patients and affects their social life. Systemic, local and surgical treatment options are available (3, 4). Endoscopic thoracic sympathectomy (ETS) appears to be the most effective treatment option especially in patients with severe sweating because medical treatment applications cannot provide a definite solution and require repeated applications (5).

Surgical treatment aims to prevent excessive sweating by eliminating sympathetic stimulation on the sweat glands located in the upper extremities, head and neck regions. This procedure is performed by clipping, cutting or cauterising the paravertebral sympathetic chain in both hemithoraces at levels between T2-T4 according to the surgeon's preference (6-9). The success rate of surgical treatment is quite high and has been reported to be 97-99% for palmar hyperhidrosis, 85-90% for axillary hyperhidrosis and 85-90% for facial hyperhidrosis (6, 10, 11). Endoscopic thoracic sympathectomy is actually not a method applied for plantar hyperhidrosis. However, it is known that complaints regress or cease in some of this patient group after thoracic sympathectomy. This partial relief following upper thoracic sympathectomy may be regarded as a negative feedback mechanism, which is triggered by an improvement in the patient's emotional and psychological state. This improvement leads to a decrease in pressure on the patient by way of cessation of palmar and axillary sweating. The feet are innervated by the efferent sudomotor fibres, which originate from T10 to L4. Lumbar sympathectomy has been demonstrated to be the most efficacious treatment option for patients afflicted solely with plantar sweating. Nevertheless, the efficacy of thoracic lower sympathetomy techniques has also been demonstrated in the treatment of plantar complaints. It has been demonstrated that interruption of the T4-T5 or more specifically the T10-T12 sympathetic chain provides superior relief from plantar symptoms (12-17). The most important reason for postoperative failure or recurrence is misidentification of the sympathetic chain and denervation at an inappropriate level.

It has been shown that patients have very high satisfaction rates after surgical treatment and generally find the treatment satisfactory (12). The most important reason for patient dissatisfaction is compensatory sweating which is the most common complication after sympathectomy (13-15). Compensatory sweating may be related with multilevel nerve dissection, climatic and geographical reasons and emotional states.

The sympathetic nerve is also the system that controls the tone of the vascular bed. After sympathicotomy, vasodilatation and blood flow increase develop in the cutaneous vascular structures of the upper extremity. Accordingly, palmar temperature increase is expected. In this study, it is aimed to evaluate the effectiveness of sympathectomy procedure with palmar and plantar temperature monitoring and to compare them by questioning patient satisfaction.

Material and Method

The files and operative records of patients who underwent videothoracoscopic thoracic sympathectomy between 2011-2012 for idiopathic hyperhidrosis at our Thoracic Surgery Department were retrospectively analysed. Preoperative chest radiographs, thyroid function tests, electrocardiography, routine blood biochemistry and haemogram tests were performed in all patients. Patients without an informed consent form were not included in the study. Patients with intrathoracic adhesions excluded. In these patients, the primary objective was to prevent any potential temperature changes that may occur as a consequence of inflammation, resulting from increased tissue dissection and damage when compared to conventional surgical procedures. Additionally, the aim was to ensure that the measured temperature values did not exceed those recorded during the study. In addition, the study was thought to be affected by confusion caused by difficulties in identifying the sympathetic chain due to adhesions and pleural thickening. After exclution of patients who could not be reached for the postoperative evaluation questionnaire, 30 patients without any additional disease were included in the study.

Demographic characteristics, operative data, temperature measurement results, complication

development, presence of compensatory sweating, and satisfaction questionnaire results were recorded. The study was approved by Ege University Ethical Committee (Registration Number :11-11.1/65 07.12.2011).

Statistical Analysis

All statistical analyses were performed using SPSS 25.0 (IBM SPSS Statistics 25 software (Armonk, NY: IBM Corp.)). Continuous variables were defined by the mean ± standard deviation and categorical variables were defined by number and percent. Shapiro wilk test was used for determination of normal distribution. For independent group comparisons Mann Whitney U test was used. For dependent group comparisons Friedman test followed by post hoc Wilcoxon signed rank test with Bonferroni correction (for 4 measurement points) and Wilcoxon signed rank test (for 2 measurement points) were used. $p<0.05$ was considered statistically significant.

Surgical Technique

After the patients were intubated with a single-lumen endotracheal tube, a semi-fowler position was given with the arms in ninety degrees of abduction and flexion at the elbow during the operation. For the bilateral sympathectomy procedure, the same procedures were performed in both hemithoraces in the same session, starting from the right hemithorax. Two 0.5 cm incisions were made through the third intercostal space and thoracoports were placed. The thorax was entered with a 5 mm 30° camera (Karl-Storz 2600 BA 5mm 30°) and the sympathetic chain was identified. After the patients were ventilated with 100% oxygen, sympathectomy was performed with ultrasonic dissection device (Harmonic Scalpel Ethicon Endosurgery and AutoSonics-Covidien) at the level of T3 for palmar hyperhidrosis, T3 and T4 for axillary hyperhidrosis. The thorax was connected to closed underwater drainage with a 16 F thoracic drain. Patients were monitored throughout the operation by monitoring palmar temperature changes with a heat probe (Nihon Kohden YSI 409JG) placed on the palms of the hands in the tenar region. After induction of anaesthesia, palm temperature was measured and recorded before the sympathetic nerve was incised. Palm temperature measurements were repeated at the 5th, 10th and 15th minutes after sympathectomy. All values were recorded. Plantar region temperature changes were measured twice before and after the procedure. All patients were extubated and taken to intensive care unit. After the chest radiograph taken at the first postoperative hour showed that there was no expansion failure, the drains were removed and the patients were followed up in the ward. Patients with no pathological findings on the control chest radiograph on the first postoperative day were discharged.

In addition, a satisfaction evaluation questionnaire was administered to the patients at the 1st postoperative month. In the questionnaire, the patients were asked to answer the following questions: I) Whether there was compensatory sweating, if any, its location and amount (very little, little, moderate, moderate, very much), II) The status of their complaints (stopped, decreased, same, increased), III) General satisfaction evaluation after the operation (poor, average, good, excellent).

Statistical analyses were performed using Statistical Package for Social Sciences (SPSS) 16.0 software. ‘t’ and “chi-square” tests were used for the general characteristics of the patients; “Mann-Whitney U”, “Friedman” and “Wilcoxon” tests were used for the comparison of temperature values and temperature increase between the groups and the evaluation of their relationship with postoperative satisfaction and complications. $p<0.05$ was considered statistically significant.

Results

Of the 30 operated patients, 10 (33.3%) were male and 20 (66.7%) were female with a mean age of 25.3±5.3 (17-36) years. 11 (36.7%) of the patients had a family history of hyperhidrosis. 5 patients (16.7%) had isolated palmar sweating and 11 patients (36.6%) had palmar and plantar sweating. T3 sympathectomy was performed in this patient group. In the remaining 14 patients who underwent T3 and T4 sympathectomy, 2 (6.6%) had isolated axillary sweating, 2 (6.6%) had palmar and axillary sweating, and 10 (33.5%) had palmar, plantar and axillary sweating.

The incidence of Kuntz nerve was 66.7% (20 patients). Sweating was observed synchronously in all patients except seven patients with isolated sweating. In the postoperative period, 1 patient (3.3%) had an expansion defect which regressed with oxygen therapy. Horner's syndrome, haemorrhage or pleural effusion were not seen in any patient.

An increase was observed in both hands compared to the pre-treatment temperature values (Table 1). The mean temperature increase at the end of 15 minutes was 1.3 °C for the right hand

and 1.6 °C for the left hand. The temperature increases measured at 5 minute intervals in both hands and at the end of the procedure were statistically significant (Right hand p=0.0001 Friedman test value=80.177; Left hand p=0.0001 Friedman test value=78.196) (Figure 1).

Table 1. Mean palmar temperature measurement, values before and after sympathectomy

	İnitial	5th minute	10th minute	15th minute
Right hand	32.7 ± 2.1	33.3 ± 1.9	33.7 ± 1.6	34 ± 1.5
Left hand	31.6 ± 1.9	32.2 ± 2.04	32.7 ± 1.9	33.2 ± 1.7

Mean ± Standard Deviation

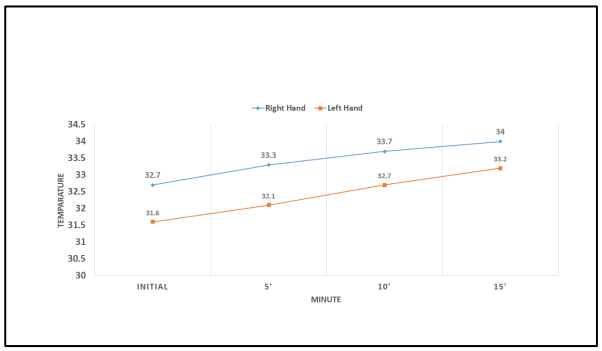

Figure 1. Heat change in the right and left hand over time

When the temperature increases were compared according to the level of sympathectomy, no significant difference was found between T3 and T3+T4 groups (Right hand p=0.142 Mann Whitney U test z=-1.479; Left hand p=0.759 Mann Whitney U test z=-0.333). When analysed within the groups, palmar temperature increases after T3 or T3+T4 sympathectomy were statistically significantly increased compared to the preoperative temperature (Right hand T3 p=0.0001 Friedman=41.431; T4 p=0.0001 Friedman=38.911). The same statistical significance was also valid for the left hand (Left hand T3 p=0.0001 Friedman=48; T4 p=0.0001 Friedman=30.8) (Figure 2a and b).

In the measurements made in the plantar region, no increase in temperature was observed when the preoperative and postoperative values were compared. A mean decrease of 0.13 °C in the right foot and 0.02 °C in the left foot was observed (Figure 3), but statistical significance was not found for both values (Right foot p=0.586 Wilcoxon z=-0.545; Left foot p=0.634 Wilcoxon z=-0.476).

Palmar hyperhidrosis disappeared in all patients. Of the 14 patients with axillary hyperhidrosis, 7 (50%) reported complete cessation of sweating, 5 (35.7%) reported a significant decrease in sweating, and 2 (14.3%) reported that sweating remained the same. In 13 (61.9%) of 21 patients who were operated for palmar or axillary sweating and who also had plantar hyperhidrosis complaints, plantar complaints regressed (Table 2)

a. **b.**

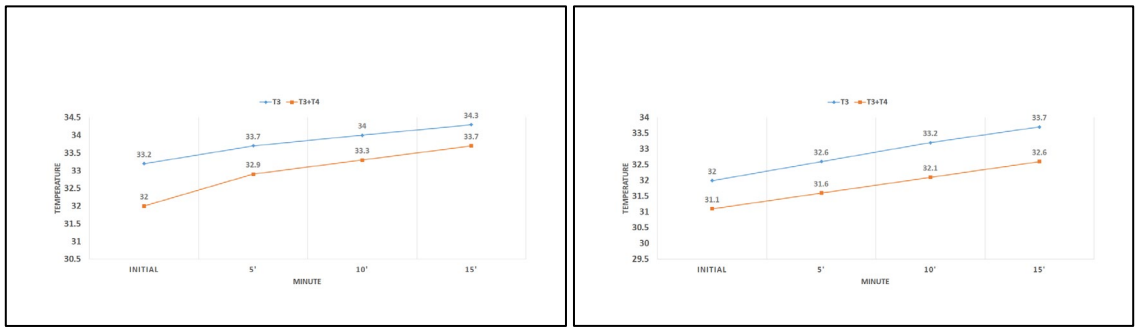

Figure 2. Temperature values monitored over time according to the level of sympathectomy in the right hand (a) and left hand (b).

Discussion

One of the important points in ETS is the level of sympathetic chain dissection. In addition to publications emphasising that the effectiveness of the operation may decrease in sympathicotomies performed by preserving T2, there are also studies supporting that only T3 sympathectomy is sufficient for palmar hyperhidrosis and T3+T4 denervation is sufficient for axillary hyperhidrosis (16-18). In studies indicating that denervation at T2 level is generally not necessary, it has been emphasised that including T2 in the procedure may cause unnecessary dissection and lead to complications requiring intervention such as bleeding and effusion, and may increase the risk of serious morbidities such as Horner's syndrome and compensatory sweating, which are permanent and

affect the patient's subsequent daily life (16, 18-20). For these reasons, in our clinic, we perform dissection at T3 level for palmar hyperhidrosis and T3+T4 level for axillary hyperhidrosis, preserving the T2 level.

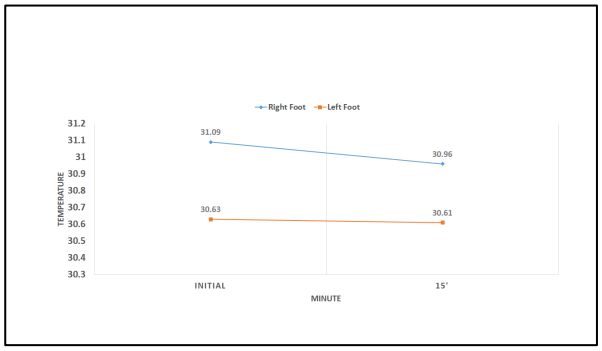

Figure 3. Temperature changes monitored over time in the right and left foot

The most common complication of ETS and the most complained complication by patients is compensatory hyperhidrosis. It is thought that multi-level dissection of the sympathetic chain increases the incidence of compensatory sweating (21). Because the more sweat glands that are out of the control of the thermoregulatory centre, the more stimulation is increased for other sweat glands (16). In a series of 222 patients, Dewey et al. (20) found compensatory sweating with a rate of 85% and emphasised that this was most frequently observed in the group in which T2 nerve ablation was performed. In our study, compensatory sweating was not observed in only one of the patients (3.3%). However, only six (20%) of those who developed compensatory sweating stated that the sweating was very severe and in addition to the aforementioned data, when evaluated in conjunction with the satisfaction rate, a mere 3% of patients assessed the surgical outcome as 'poor'. In the study of Wu et al. the prevalence of compensatory sweating was found to be 78.9%, with 23% of cases classified as severe (27). The cases in the study have been classified as severe, a category which is proximate to our own severe degree rate. In the case series of Yuncu et al., which is similar to the present study, compensatory sweating was observed in all patients who underwent T3-T4 sympathectomy, after one year follow up. T.S. Santos et al. in their study evaluated compensatory hyperhidrosis and found the most severe and high rate of sweating at the end of the first postoperative year in the craniofacial group with T2 denervation (28,29). In both of these studies, and in our own, patients were evaluated in the first year following surgery. The temporal limitation in this instance is regarded to be brief, particularly with regard to the evaluation process of compensatory sweating. In the follow-up of patients who underwent sympathectomy for palmar hyperhidrosis for a period of two years, Wang et al. found that compensatory sweating regressed over time (30). Shabat et. al. surveyed the patients after T2-T4 sympathectomy for palmar hyperhidrosis. 90% of patients exhibited compensatory sweating. However, a significant proportion of these patients, 77.8%, expressed a positive attitude towards recommending sympathectomy surgery to others. The higher rate of compensatory sweating observed in this study was attributed to the comprehensive evaluation of all complaints, irrespective of their severity, (31). In a similar instance, when moderate and severe compensatory sweating is taken into consideration, a rate of 57% is observed in the present study. When the relationship between the level of sympathectomy and the severity of compensatory sweating was investigated, no statistically significant difference was found between the groups.

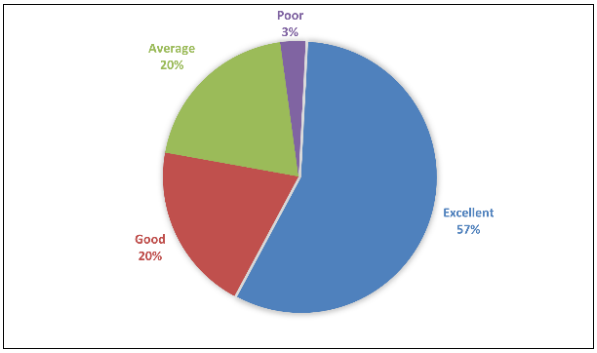

Figure 4. Evaluation of satisfaction in patients undergoing sympathectomy for idiopathic hyperhidrosis

Table 2. Degree of healing according to incision sites in plantar hyperhidrosis

	Dissolved	Diminished	Same	Total
T3	0	8 (72.7%)	3 (27.3%)	11
T3+T4	1 (10%)	5 (50%)	4 (40%)	10
Total	1 (4.8%)	13 (61.9%)	7 (33.3%)	21

Horner's syndrome is the most feared complication of ETS. The most important cause of this syndrome is misidentification of the sympathetic chain and dissection of the upper levels. There is a risk of Horner's syndrome in procedures performed in and around the T2 ganglion. The use of electrocautery may also cause Horner's syndrome. Transient Horner's syndrome may be observed by conduction of electrical stimulation along the nerve and thermal damage (22). Therefore, we prefer ultrasonic dissection device with hooked tip instead of electrocautery in ETS operations. Horner's syndrome did not occur in any of the patients in our study.

In ETS operations for idiopathic hyperhidrosis, the aim is to perform the minimal dissection possible without affecting the success rate of the operation and to cause the least tissue trauma. Due to anatomical variations, inflammatory and infectious changes, identification of the sympathetic chain can sometimes be difficult. After misidentification of the sympathetic chain or incomplete sympathectomy, the recurrence rate increases, the risk of peroperative complications may increase and the operation time may be prolonged. Methods such as palmar temperature change monitoring and palmar blood flow monitoring with Doppler may provide both peroperative confirmation of whether denervation is performed at the correct level and increase the efficiency of the operation and minimise the risk or severity of compensatory sweating with less tissue and nerve dissection (21, 23). In studies on palmar temperature monitoring, it has been reported that a palmar temperature increase of more than 1 ºC is sufficient to predict a successful operation (21-25). In the series of Crandhall et al.(25), the mean temperature increase was found to be 2.8 ºC and it was reported that complaints regressed in all patients. It was also reported that there may be a transient sudden increase in temperature at the first moment while the nerve is cauterised, but a significant increase in blood flow and temperature occurs in the 10th and 15th minutes after complete denervation. In another study in which palmar blood flow monitoring and palmar temperature monitoring were performed simultaneously with Doppler, it was observed that the temperature increase occurred later than the blood flow increase and was reflected in the measurement later (26). Therefore, for an accurate evaluation, palmar temperature monitoring should be started before skin incision is made and temperature measurement should be continued for at least 15 minutes after sympathectomy.

In the study by Fujita et al. (21), T2-T4 sympathectomy was performed and the mean temperature increase was found to be 4.2 ºC. All patients in the series developed compensatory sweating and the authors emphasised that the higher the intraoperative temperature rise, the higher the rate of compensatory sweating. Eisenach et al. (26), on the other hand, reported a mean increase of 1.2 ºC in palmar temperature in their study and that all patients' sweating complaints ceased and patient satisfaction was 100% in postoperative evaluations. In addition, in other studies with temperature increases up to 3 ºC, it was stated that this excessive increase was due to techniques that caused excessive tissue destruction and this increased compensatory sweating. In our study, palmar temperature increase was observed in all patients after sympathectomy. In the follow-up, the temperature increase was continuous in 5 minute periods and the measured value did not decrease compared to the previous temperature value in any patient. The temperature increase was at the highest level at 15 minutes. The mean temperature increase was 1.3 ºC for the right hand and 1.6 ºC for the left hand. After sympathectomy at T3 level for palmar hyperhidrosis, the complaints of all patients improved. Axillary complaints did not resolve in 2 (14.2%) of 14 patients in whom T4 denervation was added because of axilla sweating. Sapena et al. (23), in their study in which T2-T4 sympathectomy was performed in 73 patients, emphasised that the maximum temperature reached was more important than the mean temperature increase and that a measurement closer to 36 ºC rather than 35 ºC was ideal after a successful operation. Despite the high success and satisfaction rates in our study, the mean maximum temperature was 34 ºC in the right hand and 33.2 ºC in the left hand at 15 minutes, and the mean temperature increase was over 1ºC. There was no significant correlation between the values measured at 15 minutes after sympathectomy and patient satisfaction or success rate. Therefore, we think that the maximum palmar temperature value reached after the operation is not an indicator of an effective treatment.

In addition to incomplete or incorrectly performed sympathectomy, Kuntz nerve is also a factor in the failure of ETS. In cadaveric studies, Kuntz nerve was found in 34.9% on the right and 51% on the left. In our study, Kuntz nerve was present in 66.7% of the cases. If Kuntz's nerve is present, palmar temperature monitoring is not meaningful in verifying the effectiveness of the

procedure. Although the temperature increases with nerve denervation, sympathetic conduction with Kuntz continues. Therefore, the Kuntz nerve should be found and cauterised or a 3 cm section from the costal head to the lateral aspect should be coagulated continuously with cautery while performing sympathectomy.

ETS is not a method primarily used in the treatment of plantar hyperhidrosis. However, the severity of plantar sweating may be reduced or eliminated in some patients operated for palmar hyperhidrosis. Rodriguez et al. (27) reported that 76.7% of 406 patients who underwent T2-T3 sympathectomy for palmar sweating and T3-T4 sympathectomy for axillary sweating also had plantar hyperhidrosis complaints and 42.4% of this group with plantar complaints improved, 42.4% had no change and 15.2% had increased sweating after the operation. In our study, 21 patients had plantar complaints at the same time. After the operation, 13 patients (61.9%) had partial improvement in plantar hyperhidrosis, 7 (33.3%) had no change, and 1 patient (4.8%) had complete improvement. There was no significant difference between the T3 sympathectomy group and the T3-T4 sympathectomy group in terms of success in plantar sweating. Wolosker N et al. found that in patients with palmar and plantar sweating, improvement in plantar sweating was found in 30% of patients 1 year after T3 and T4 sympathectomy operations. No difference was found between sympathectomy level and improvement in plantar hyperhidrosis (28). In a study in which T2-T3 sympathicolysis was performed in patients with plantar sweating associated with palmar hyperhidrosis, complete drying or reduction was observed in 51% (29). Sympathetic innervation of the foot and leg originates from the ipsilateral T10-L4 segment and lumbar sympathectomy is performed for plantar hyperhidrosis. Jeong et al. performed lower thoracic (T10-T12) sympathectomy (LTS) in addition to conventional sympathectomy in some patients with palmoplantar or palmoplantoaxillary sweating. In these patients, a significant reduction in plantar sweating was found compared to the group without LTS and no significant difference was found in compensatory sweating (30). In all three studies, a consensus was reached that these applications should not be applied in patients with isolated plantar hyperhidrosis (29,30). When plantar temperature measurements were evaluated in our study, it was observed that no increase in temperature was observed in both feet, and even a slight decrease in temperature measurements that did not show statistical significance compared to preoperative values was observed. We think that plantar temperature monitoring during thoracic sympathectomy is not significant in showing the success of the operation.

The main limitation of our study is small number of patients. This is a single centered study and patients were retrospectively asked to reply a survey in a short period. Further studies are needed involving large group and evaluation long term results of sympathectomy. Furthermore different level of sympathectomy or other interventions for blockade of sympathetic chain should be analysed for accuracy of this method.

Conclusion

In our study, it was revealed that all patients who underwent sympathectomy for idiopathic hyperhidrosis had a peroperative palmar temperature increase and palmar complaints completely disappeared in all 28 patients with palmar sweating. Therefore, we believe that the observation of palmar temperature increase with peroperative temperature monitoring can verify the accuracy of the procedure. This not only gives the surgeon an idea about the success of the procedure during the operation, but also reduces postoperative complications by preventing extra tissue dissection.

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None.

Conflict of interest statement

All authors declare no conflicts of interest.

Ethics Committee Approval

The study was approved by Ege University Ethical Committee (Registration Number :11-11.1/65 07.12.2011). Informed consent was obtained from all patients.

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