

Clinical Outcomes of Uniportal Versus Multiportal Endoscopic Thoracic Sympathectomy in Patients With Severe Palmar and Axillary Hyperhidrosis

Şiddetli Palmar ve Aksiller Hiperhidrozu Olan Hastalarda Uniportal ve Multiportal Endoskopik Torasik Sempatektomi'nin Klinik Sonuçları

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ABSTRACT

Aim: Palmar and axillary hyperhidrosis is caused by overstimulation of the sympathetic nervous system that control the sweat glands. This study compares the clinical consequences of uniportal and multiportal thoracic endoscopic thoracic sympathectomy (ETS), in cases of severe palmar and axillary hyperhidrosis.

Methods: In this retrospective study, forty-one patients who were diagnosed as severe palmar and axillary primary hyperhidrosis were analyzed. These underwent multiportal ETS between 2015 and 2020 at our thoracic surgery clinic. They were divided into two groups, 24 as uniportal (58.5%) and 17 as multiportal (41.5%). They were compared in terms of the length of hospital stay, the initial complications and possible recurrences after three months. Descriptive statistics were used to evaluate stratified and continuous variables.

Results: There was no significant difference in moderate pain between the two groups. There was a significant difference between the two groups in terms of 3 days or more hospitalization. There were no significant difference related to the rate of complications such as ptosis, Horner syndrome, increased duration of surgery and recurrence rate of hyperhidrosis 3 months after surgery. Some mild to moderate side effects disappeared spontaneously at 6-month follow-up.

Conclusion: The results showed that uniportal and multiportal endoscopic thoracic sympathectomy (EST) are very effective, safe and minimally invasive methods for the treatment of palmar and axillary hyperhidrosis. Compared to the multiportal approach, uniportal EST causes less postoperative pain and less surgical duration.

Keywords: Uniportal, Multiportal, ETS, Hyperhidrosis.

ÖZ

Amaç: Palmar ve aksiller hiperhidroz, ter bezlerini kontrol eden sempatik sinir sisteminin aşırı uyarılmasından kaynaklanır. Bu çalışma, şiddetli palmar ve aksiller hiperhidroz vakalarında uniportal ve multiportal torasik endoskopik torasik sempatektominin (ETS) klinik sonuçlarını karşılaştırmaktadır.

Yöntemler: Bu retrospektif çalışmada şiddetli palmar ve aksiller primer hiperhidroz tanısı konulan 41 hasta incelendi. 2015-2020 yılları arasında göğüs cerrahisi kliniğimizde tüm vakalarımıza ETS uygulandı. Uniportal 24 (%58,5) ve 17 Multiportal (%41,5) olmak üzere iki gruba ayrıldılar. Hastanede kalış süreleri, ilk komplikasyonlar ve üç ay sonra olası nüksler açısından karşılaştırıldılar. Tabakalı ve sürekli değişkenleri değerlendirmek için tanımlayıcı istatistikler kullanıldı.

Bulgular: İki grup arasında orta derecede ağrı açısından anlamlı bir fark yoktu. Hastanede 3 gün ve üzeri yatış açısından iki grup arasında anlamlı fark vardı. Ameliyattan 3 ay sonra ptosis, Horner sendromu, ameliyat süresinin uzaması ve hiperhidrozun tekrarlama oranı gibi komplikasyon oranları arasında anlamlı fark yoktu. Bazı hafif ila orta dereceli yan etkiler 6 aylık takipte kendiliğinden kayboldu.

Sonuç: Sonuçlar, palmar ve aksiller hiperhidroz tedavisinde uniportal ve multiportal endoskopik torakoskopik sempatektominin (EST) çok etkili, güvenli ve minimal invaziv yöntemler olduğunu göstermiştir. Multiportal yaklaşımla karşılaştırıldığında, uniportal ETS daha az postoperatif ağrıya ve daha az cerrahi süreye neden olur.

Anahtar Kelimeler: Uniportal, Multiportal, ETS, Hiperhidrosis

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INTRODUCTION

Sweating is a vital defense mechanism that ensures the thermoregulation of our body and it is controlled by the hypothalamus, cerebral cortex and sympathetic autonomic nervous system [1]. In some people, as a result of sympathetic overactivity, hyperhidrosis occurs specifically in some areas, especially the hands, axillary groin, foot soles, back and abdomen [2].

Secondary hyperhidrosis is the result of other causes such as malignancy, endocrine disorders or the side effects of some drugs or medications, whereas in primary hyperhidrosis, the nerves responsible for signaling the sweat glands become overactive [1,3]. Common treatments include the use of skin creams, systemic anticholinergic drugs, topical injection of botulinum toxin A, and even surgical procedures [1, 3, 4]. Surgical procedures include local removal of axillary sweat glands as well as thoroscopic blocking of certain branches of the thoracic sympathetic chain [5]. The surgical approaches may be performed by open or endoscopic techniques [6].

Endoscopic Thoracic Sympathectomy (ETS) is a closed surgical procedure in which specific branches of the thoracic sympathetic chain is blocked [7]. It is an alternative, safe and durable treatment procedure performed by excision, electrocoagulation or application of surgical clips on the thoracic sympathetic ganglia, between T2 and T4 or T5 (8). It is also an effective and aesthetically remarkable procedure to treat primary hyperhidrosis [9].

As a result of its minimally invasive character, it has become the preferred surgical procedure in the recent years. In such cases, due to the satisfactory early outcomes, namely short hospital stays and low complications, the procedure is highly tolerable[3].

In this study, we aimed to clinically compare the outcomes of uniportal and multiportal endoscopic thoracic sympathectomy (ETS) in cases with severe palmar and axillary hyperhidrosis, in patients who did not respond to the conservative therapeutics.

PATIENTS AND METHODS

In this retrospective study, forty-one patients who were diagnosed as severe palmar and axillary primary hyperhidrosis were studied. They did not respond to conservative therapies and underwent thoroscopic sympathectomy between 2015 and 2020 in our thoracic surgery clinic.

We excluded the patients who had to undergo thoracotomy due to pleural adhesions and the patients who couldn't be followed up after 1 and 3 months later. We included all patients who could be operated endoscopically and bilaterally because of they didn't respond to conservative treatment.

For each patient, a questionnaire containing demographic information, underlying diseases, skin perspiration (Hyperhidrosis) and consent was recorded before surgery. Chest X-rays were also performed to ensure the absence of potential pleural symphysis. All this information was obtained once more, one and three months after surgery and their symptoms (in particular skin moisture) were compared with pre-surgery. Similarly, possible complications such as hemothorax, pneumothorax, Horner's syndrome, etc. were followed up. Through the final follow-up, we assessed patients' pain using the Visual Analogue Scale (VAS).

The surgical procedure consisted of the following steps:

Subsequent to a double-lumen endotracheal tube intubation, general anesthesia was induced. The patient was placed on a dorsal decubitus, semi-sitting (trunk with 45° flexion) position. Two small (roll-like) pads were placed under the patient's shoulder. These arrangements created enough space between the axilla and the ports. Another pad was also placed below the knees. To ensure the patient's position when rotating left and right, the hip area was fixed to the bed.

In both uniportal and multiportal modes, the mediastinum pleura was removed and cauterized at the top of the thoracic sympathetic chain using a monopolar endo-hook. Then the thoracic sympathetic chain also appeared and turned.

In the uniportal procedure, a 2 cm incision was required between the middle and anterior axillary lines in the fifth intercostal space. After the

lung was deflated (collapsed), clips was placed between the T2-T4 sympathetic chains by entering through portal. The sympathetic chain along with the Kuntz nerve around the sympathetic ganglia was identified and a clip was placed between T2-T4 of the sympathetic chain.

In the multiportal procedure, the camera was inserted into the chest with a 1 cm incision and the dissector was inserted into the chest using a 5 mm incision. The first incision was made around the anterior axillary line and on the fifth anterior intercostal space, through which the camera entered the thoracic cavity. To reduce possible side effects, the second port entered the thorax under direct vision after the camera was inserted into the thoracic cavity. The patient's pleura in the sympathetic chain pathway was opened from T2 to T4 and a clip was placed between communication branches.

In no case did we cauterize or cut the sympathetic branches. In many of them, the Kuntz branch was cauterized and in no case was the chest tube inserted postoperatively.

In both procedures, after complete homeostasis, the lung was reinflated to fully open the collapsed lung. The direct view of the camera ensured that the lungs opened. The camera was then removed and the incision was sutured.

Based on the objectives of the study, we compared the length of hospital stay, the initial complications and possible recurrence of palmar and axillary hyperhidrosis in both uniportal and multiportal cases, after 3 months.

In this study, descriptive statistics for stratified and continuous variables were used. Homogeneity of variance was assessed by the Levene test and the Shapiro-Wilk test was conducted for normality. Student's t-distribution, one-way variance, Kruskal-Wallis and Bonferroni tests were run. Relationships between class variables were analyzed by the Fisher test and the Chi-square test. In cases which the expected frequencies were less than 20, the Monte Carlo simulation was included. The p values were considered statistically significant less than 0.05 and 0.01. The SPSS 25 software was used to perform the quantitative analysis.

RESULTS

Twenty-three cases (56.1%) were male and eighteen cases were female (43.9%). Descriptive statistics including age, gender, postoperative complications, hospital stay, and recurrence rate of hyperhidrosis after 3 months are summarized in Table 1.

Table 1. Descriptive statistics related to class variables

Variables	Category	N	%
Sex	male	23	56.1
	female	18	43.9
Surgery time	30 minutes or less	11	26.8
	Between 30-60 minutes	23	56.1
	More than 1 hour	7	17.1
Portal	Uniportal	24	58.5
	Multiportal	17	41.5
Ptosis	Occurred	3	7.3
	Did not occur	38	92.7
Horner syndrome	Occurred	2	4.9
	Did not occur	37	95.1
Hospitalization	1 day	24	58.5
	2 days	11	26.8
	3 day and more	6	14.6
Recurrence after 3 months	Occurred	2	4.9
	Did not occur	39	95.1
	Total	41	100.0

The age of the patients varied between 15 and 50 years, with an average of 27 and an average of 25 (most cases between 20 and 30 years of age) (Table 2).

Table 2. Descriptive statistics related to the continuous variable of age

	N	Minimum	Maximum	Average	Standard deviation
Age	41	15.00	50.00	27.6829	8.92591

All of them tried at least one conservative treatment before accepting the surgical approach and failed to get the desired results. Uniportal procedures included twenty-four cases and multiportal seventeen cases, respectively.

Postoperative pain in uniportal cases was significantly lower than in multiportal group ($P < 0.001$). Complaints of severe pain were seen in 18.2% of cases in the uniportal group and in

81.8% of the multiportal group. Mild to severe pain was also significantly different between the two groups (90.0% in the uniportal group vs. 10.0% in the multiportal group). There was no significant difference in moderate pain between the two groups.

Due to the lower pain severity, the length of hospital stay after ETS was also significantly lower in the uniportal group ($p < 0.001$). The difference in the length of one-day hospital stay was also significantly different between the two groups (83.3% in the uniportal group vs. 16.7% in the multiportal group).

Similarly, a significant difference in the length of two-day hospitalization was also seen between the two groups (27.3% in the uniportal group vs. 72.7% in the multiportal group). There was also a significant difference between the two groups in terms of 3 days or more hospitalization (16.7% of the uniportal group vs. 83.3% of the multiportal group).

There were no statistically significant differences between the two groups in terms of side effects such as ptosis ($p < 0.767$), Horner syndrome ($p < 0.802$), duration of surgery ($P < 0.169$) and recurrence rate 3 months after surgery ($p < 0.802$) (Table 3).

There were also no deaths in any of the cases. Intraoperative vascular injury, thoracic duct injury, postoperative hemothorax and pneumothorax did not develop in any of cases.

Despite the fact that in no case was the chest tube inserted, we did not encounter hemothorax or pneumothorax after the operation and at the one-week follow-up. Horner's syndrome was observed in only one case in both groups. Ptosis occurred in two cases of uniportal group and in one case of multiportal group. However, in all cases it disappeared spontaneously at the 6-month follow-up. Blepharoplasty was not required and the clinical manifestations of two cases of Horner's syndrome significantly subsided after 6 months.

DISCUSSION

In this comparative study, we found that our patients complained of less pain in the uniportal ETS group and their length of stay in the hospital

was significantly shorter.

Although there are many studies in the literature comparing single-port and multi-port methods in endoscopic spontaneous pneumothorax surgery and endoscopic lung resection surgeries [6], we found few publications comparing single and multi-port methods in ETS surgeries. For this reason, we think the results of our study may be useful.

Hyperhidrosis disrupts the quality of life and results in problems ranging from a reduction in social life to isolation. Although treatments such as locally effective ointments, systemic anticholinergic drugs and local botulinum A are used, the most effective results are obtained with the surgical technique called endoscopic thoracic sympathectomy (ETS) [10,11].

In the last two decades in particular, ETS surgeries have been performed effectively in cases of hyperhidrosis. With ETS, the T2-T4 interval of the thoracic sympathetic chain is blocked by various methods, and thus hand and armpit sweating is interrupted [1, 13]. The most preferred methods in sympathetic chain blockade are cauterization of the relevant part of the sympathetic chain, cutting with scissors and clipping [13, 14]. We preferred the clipping method in our cases where we applied ETS in our clinic as it is possible to encounter unexpected conditions, such as ptosis and Horner's syndrome, as the burn effect continues to the lower and upper parts of the sympathetic chain after cauterization [15].

In some patients, after the surgery, symptoms such as compensatory hyperhidrosis may occur, that may negatively affect patient satisfaction. In other cases, permanent bradycardia may develop following surgery [1, 16]. In such cases, it may be necessary to unblock the sympathetic chain again. This is not possible if the thoracic sympathetic chain is cut with scissors or cauterized. Due to the lower incidence of complications, we chose clipping to block thoracic sympathetic branches. However, because of the familiarity on the part of surgeons, cauterization is probably a more common method.

ETS surgeries can be performed from 2 or 3 ports as well as from a single port, which has been increasingly used in recent years [17]. The biggest

Table 3. Comparison of portal categories with variables of gender, duration of surgery and postoperative complications (*p<0,05)

Variables	Category		Portal		Total	X ²	p
			Uniportal	Multiportal			
Sex	Male	n	14a	9a	23	0.117	0.732
		%	60.9%	39.1%	100.0%		
	Female	n	10a	8a	18		
		%	55.6%	44.4%	100.0%		
Duration of surgery	30 minutes or less	n	8a	3a	11	3.554	0.169
		%	72.7%	27.3%	100.0%		
	Between 30-60 minutes	n	14a	9a	23		
		%	60.9%	39.1%	100.0%		
	More than 1 hour	n	2a	5a	7		
		%	28.6%	71.4%	100.0%		
Pain	Very severe	n	2a	9b	11	16.954	0.001*
		%	18.2%	81.8%	100.0%		
	Moderate severe	n	4a	6a	10		
		%	40.0%	60.0%	100.0%		
	Mild severe	n	18a	2b	20		
		%	90.0%	10.0%	100.0%		
Ptosis	Occurred	n	2a	1a	3	0.088	0.767
		%	66.7%	33.3%	100.0%		
	Did not occur	n	22a	16a	38		
		%	57.9%	42.1%	100.0%		
Horner's syndrome	Occurred	n	1a	1a	2	0.063	0.802
		%	50.0%	50.0%	100.0%		
	Did not occur	n	23a	16a	39		
		%	59.0%	41.0%	100.0%		
Hospitalization	1 day	n	20a	4b	24	14.844	0.001*
		%	83.3%	16.7%	100.0%		
	2 days	n	3a	8b	11		
		%	27.3%	72.7%	100.0%		
	3 day and more	n	1a	5b	6		
		%	16.7%	83.3%	100.0%		
Recurrence after 3 months	Occurred	n	1a	1a	2	0.063	0.802
		%	50.0%	50.0%	100.0%		
	Did not occur	n	23a	16a	39		
		%	59.0%	41.0%	100.0%		
Total	n	24	17	41			
	%	58.5%	41.5%	100.0%			

advantage of using multiple ports is the possibility of inserting the camera, surgical instruments and clips from separate ports, thus obtaining more movement space for the procedure and performing it with more ease. When the surgeon uses multiple ports, a greater field of view and wider intervention area can be obtained when necessary, by inserting the camera and instruments from different ports. In contrast to these advantages, the multi-port system causes much more pain in patients compared to the single-port system [18]. Indeed, more than one intercostal space is

operated on and more than one intercostal nerve is contacted, which increases the potential for excessive pain [6]. In addition, ETS surgeries are not for the continuation of vital functions, but for the purpose of increasing the comfort of life. Therefore, aesthetic concerns cannot be ignored for this surgery: the multiple port method, which causes two or three scars, is aesthetically more disadvantageous than the single port method.

In the literature, it has been determined that postoperative pain is lower in cases performed

with the single port method, and accordingly, the duration of hospital stay is shorter [6, 17]. When we compared our ETS surgeries performed with both single port and multiple ports, we also found that our patients felt less pain in cases performed with the single port method. Patients who we operated on with multiple ports remained in the hospital for a few more days due to extreme pain. Duration of hospital stay was reduced due to less pain in the patients we operated with a single port, and this was statistically significant.

Intraoperative complications usually include intercostal vein injuries, thoracic duct injuries, subclavian artery injuries and pulmonary injuries [1]. We have not experienced such side effects in either group. Therefore, it was not possible to determine the superiority of one method over the other in terms of complications during operation.

The most common early complications are ptosis, Horner's syndrome, hemothorax and pneumothorax [19]. We did not put a chest tube after the operation in any of our cases and we did not encounter hemothorax or pneumothorax in any of our cases in the operative period, nor in the follow-ups, one week later. Horner's syndrome developed in one of our patients, both groups considered. While ptosis developed in two of our cases operated on with a single port, ptosis developed in one of our cases operated with multiple ports. In all of our cases that developed ptosis, The ptosis picture disappeared spontaneously at the 6-month follow-up. Blepharoplasty was not required and the two Horner syndromes were significantly reduced after 6 months to levels where patients did not complain. We did not find a statistically significant difference between single and multiple port methods in terms of early postoperative complications and this is compatible with the current literature.

In other studies, a recurrence rate of hyperhidrosis of 1 to 3% has been reported in the literature on ETS [20]. One of the important reasons may be that the thin branches separated from the sympathetic chain regenerate over time and restore the connection at the lower and upper parts of the blocked sympathetic chain. Most relapses usually occur after 3 months [21],

In our 3-month follow up, it was found that in one of the two groups, moistening of the hands

occurs. For both patients, this condition was not considered unfavorable. There was no significant difference between the two groups in terms of recurrence of hyperhidrosis after 3 months. This was consistent with other findings.

Chen et al. (2009) studied the results of using uniportal and biportal video-assisted thoracoscopic sympathectomy for palmar hyperhidrosis. They showed that both thoracoscopic sympathectomy procedures are effective, safe, and minimally invasive for palmar hyperhidrosis. However, there was no significant difference between the two groups in terms of mean hospital stay, compensatory sweating and patient satisfaction [22].

Georghiou et al. (2004) evaluated the mid-term outcome and value of transaxillary single-port thoracic sympathectomy, using a thoracoscope with an operating channel for treatment of hyperhidrosis. They found that single-port thoracoscopic sympathectomy resulted in positive clinical and aesthetic results, including reducing hospital stays and the risk of side effects. Patients' satisfaction with this treatment was high, although some may experience compensatory symptoms [23].

Murphy et al. (2006) compared uniportal and biportal ablation techniques. The uniportal group showed better results in terms of hospital stay, postoperative pneumothorax and need for chest tube. However, there was no correlation between the number of ports and patient satisfaction [24].

Drott (2003) studied the results of endoscopic thoracic sympathectomy (ETS) for hyperhidrosis. They have shown that severe palmar hyperhidrosis and facial blushing respond well to ETS with high patient satisfaction. Facial hyperhidrosis is effectively treated with ETS but is associated with a high risk of severe compensatory sweating (CS) [25].

Kazemzadeh et al. (2019) compared the single port thoracoscopic sympathectomy with multiport Thoracoscopy in patients with hyperhidrosis. They revealed that since the clinical outcomes and complications in single port and multi-port modes of thoracic sympathectomy are not different, for better aesthetic results, it would be preferable to

use the single-port method as an alternative to the multi-portal method [17].

All of the above studies are consistent with the results of the present study. They confirm that uniportal, biportal and multiportal endoscopic thoracoscopic sympathectomy (EST) are highly effective, safe and minimally invasive surgical procedures for treatment of palmar and axillary hyperhidrosis. Compared to biportal and multiportal procedures, the uniportal approach causes less postoperative pain and shorter surgery duration and is a more rational method of treating hyperhidrosis in these areas. There was no significant difference between the uniportal and the multiportal groups in terms of early postoperative complications, and this finding is consistent with the other studies.

Limitations

The main limitation of our study was that it was retrospective. Pain is a mental data and may vary from person to person after a trauma. Although we have tried to evaluate pain using the VAS pain scale, it is obvious that complete objectivity cannot be provided. Although we had sufficient cases to obtain statistically significant data, our number of cases was smaller than those of other studies.

CONCLUSION

In the uniportal ETS, the postoperative pain experienced by patients is reduced and accordingly, the length of stay in the hospital is decreased. There was no significant difference between uniportal and multiportal groups, in terms of early postoperative complications and recurrence rates of late sweating. A uniportal ETS is more advantageous in terms of aesthetics, hence it seems that the uniportal ETS should be preferred. We recommend that Thoracic Sympathectomy is best started with uniportal ETS and not switched to multiple ports unless it becomes absolutely necessary.

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