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Awake one stage bilateral thoracoscopic sympathectomy for palmar hyperhidrosis: a safe outpatient procedure☆

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Abstract

Objective: To verify the feasibility and compare the results of thoracoscopic sympathectomy under local anaesthesia (LA) and spontaneous breathing vs. general anaesthesia (GA) with one-lung ventilation. **Methods**: Two groups of consecutive patients underwent one stage bilateral T2–T3 thoracoscopic sympathectomy under LA ($n=15$) and GA ($n=30$) by the same surgical team for treatment of primary palmar hyperhidrosis. The groups were homogeneous for relevant demographic, physiological and clinical data, including pulmonary function. In both groups, patient's satisfaction was evaluated 24 h after surgery by a simple interview and scored into five grades (1=very poor to 5=excellent), while quality of life (QOL) was evaluated by SF-36 and Nottingham's Health Profile questionnaires before and 6 months after surgery. A cost comparison between groups concerning devices, drugs, global in operating room time, medical personnel and hospital stay was also carried out. **Results**: No operative mortality was recorded. The overall in operating room time for the whole bilateral procedure under LA was 63.55 ± 10.58 vs. 86.05 ± 5.75 under GA ($P<0.01$) and temperature increased in all patients from a baseline of 25.42 ± 0.56 up to 32.15 ± 0.84 °C. All patients undergone LA were discharged the same day after a chest roentgenogram and a short stay in the outpatient clinic. Among them three patients (20%) experienced a minimal (<30%) pneumothorax that required no treatment, while five (33.3%) had a trunk compensatory sweating that spontaneously resolved on the long run. Patients undergoing GA were discharged after a mean stay of 1.38 ± 0.6 days. Among these, eight (26.6%) had prolonged trunk compensatory sweating that did not persist longer than 3 months. At a follow-up of 7.16 ± 2.97 months, QOL was significantly improved with no difference between groups. The overall rate of satisfaction was greater in the LA group ($P<0.05$). **Conclusions**: In our study, awake one stage bilateral thoracoscopic sympathectomy for palmar hyperhidrosis could be safely and effectively performed as an outpatient procedure in patients refusing GA. Postoperative quality of life was equal to that in patients undergone the same procedure under GA, while patient satisfaction was better and cost were significantly reduced.

Keywords: Palmar hyperhidrosis; Sympathectomy; Video-assisted thoracic surgery; Local anaesthesia; Quality of life

1. Introduction

Primary palmar hyperhidrosis is characterised by excessive perspiration and is currently the most debilitating form of hyperhidrosis observed in 0.5–1% of the population. The excessive sweat is mediated by the vegetative nervous system and often begins primarily at level of the upper extremities, but may involve plantar surfaces and axillae as well. The most usual sites of hyperhidrosis are the hands in 25% of cases, armpit in 20% and both in 55%, while plantar hyperhidrosis counts up to 45% of cases [1]. The degree of sweating may reach the status of clear dripping and be aggravated by stress and anxiety, thus resulting in a psychological, social and professional burden for such patients. Conservative treatment is not always effective and often requires repeated courses of therapy that can be dismantling on the long run [2,3].

Therefore, the interruption of the upper thoracic sympathetic chain under thoracoscopic guidance has been established as the treatment of choice and has been widely adopted since many years in most thoracic surgical centres worldwide due to its safety and ability to achieve definitive cure in a surprisingly high percentage of cases [4–6]. Several minimally invasive techniques have been described so far with different results in terms of resolution of symptoms, complication and need for redo procedures, but poor emphasis has been given to the type of anaesthesia for this type of surgery [7,8]. This study has evaluated the immediate and long-term results of one stage bilateral video-assisted thoracoscopic sympathectomy under local anaesthesia (LA) in a small yet significant series of selected patients to demonstrate its feasibility as a day-surgery or

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better an outpatient procedure without the considerable risk of complications due to general anaesthesia (GA).

2. Material and methods

Between November 2001 and March 2004, 45 consecutive patients underwent one stage bilateral thoracoscopic sympathectomy for treatment of primary palmar hyperhidrosis by the same surgical team. Selection criteria included: absence of previous thoracic surgery, severe and debilitating primary palmar hyperhidrosis, repercussion on social life, repercussion on professional activity, alteration of intimate relationship, inefficacy of medical treatment, patient motivation and determination. All patients had experienced disabling palmar hyperhidrosis, since adolescence and more than one half of them (26/45; 57.7%) had tried alternative conservative treatment such as topical agents, and iontophoresis without relief, thus having their work and social life seriously affected. All patients were given the choice between undergoing GA ($n=30$) or LA ($n=15$). Each patient signed an informed consent after having been carefully educated on the possible side effects such as transient compensatory sweating, interscapular pain, Horner's syndrome. Both groups of patients were homogeneous with concern to relevant demographic data and pulmonary function testing (FEV1% predicted) as shown in Table 1.

2.1. Surgical procedure

Patients were placed in semi-prone position for each side/procedure with the ipsilateral arm abducted and mild anti-Trendeleburg inclination (Fig. 1). Monitoring included arterial and central venous blood pressure, electrocardiogram (ECG), pulse oximetry, hand temperature by means of a finger probe for both groups. In those patients undergoing GA one-lung ventilation was administered using a double-lumen endotracheal tube. On the other hand in the LA group, a percutaneous intercostal block was performed at the level of the thoracic incisions for a maximum extension of three spaces by infiltration of ropivacaine 0.75% (Astra Zeneca, Milan, Italy), 4 ml for each intercostal space. These patients maintained spontaneous breathing throughout the procedure and supplementary oxygen was administered by means of a facemask as required. After an additional LA with 10 ml of mepivacaine 2% (Astra Zeneca, Milan, Italy), two 5 mm ports (Thoracoport Soft™, Tyco Healthcare, Norwalk, Connecticut, USA) were placed, respectively, in the fourth intercostal space on midaxillary line and third intercostal space anterior to midaxillary line (anterior to the border of the latissimus dorsi muscle), the former being used to introduce a 0° telescope (Richard Wolf, Knittlingen, Germany) while dissection was performed through the other port. The first side to be approached was always the right as preferred by most surgeons. The surgical technique usually consisted of opening the parietal pleura, identifying the T2-T3 sympathetic chain and dividing by cautery communicating branches. Subsequent dissection at T2 level was always performed by endoscopic scissors to avoid possible heat injury to stellate ganglion while the T3 section was made on cautery. Surgical ablation of the sympathetic chain between T2 and T3 and electrocautery ablation of accessory branches and Kuntz nerve when present was performed in all cases to prevent relapses (Fig. 2). Patients under LA received no sedative medication or intravenous analgesic agents throughout the procedure. Lung re-expansion was video-controlled at

Table 1
Demographic and clinical characteristics of patients undergoing video-thoracoscopic sympathectomy for palmar hyperhidrosis ($n=45$)

Variable	Local ($n=15$)	General ($n=30$)	P
Sex (male/female)	6/9	13/17	NS
Median age	28.11±5.87	29.42±4.72	NS
Family history (yes/no)	6/9	11/19	NS
Previous respiratory disease	0/15	4/30	NS
FEV1% predicted	86±1.3	86±1.4	NS
Previous treatment (yes/no)	7/8	19/11	NS

Fig. 1. Patient is placed into a semi-prone position, ipsilateral arm abducted and mild anti-Trendelenburg inclination.

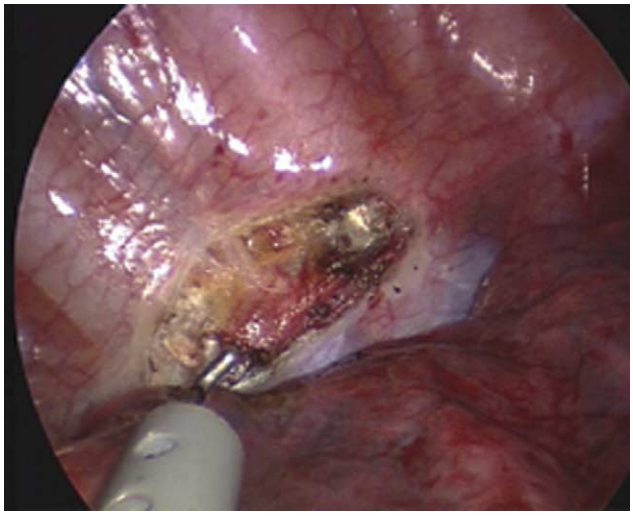

Fig. 2. Sympathetic T2–T3 trunk is dissected while lung is partially collapsed in the awake patient.

Table 2
Quality of life after thoracoscopic sympathectomy evaluated by SF-36 and NHP questionnaires: local ($n=15$) vs. general anaesthesia ($n=30$)

SF-36	Pre	Post	Change	*P*	NHP	Pre	Post	Delta	*P*
Local anaesthesia									
General	53,44	72,34	18,9	0.001	General	23,53	14,03	9,65	0.01
PF	38,06	62,78	24,72	0.03	Mobility	12,51	8,91	3,6	NS
RP	69,44	70,83	1,39	NS	Energy	30,41	16,26	14,15	NS
SF	63,89	88,83	24,94	0.004	Sleep	10,61	5,34	5,27	NS
RE	57,37	83,35	25,98	0.001	Pain	47	28,67	18,33	0.001
MH	58	72,22	14,22	0.01	Isolation	1,63	0	1,63	NS
BP	35,28	55,39	20,11	0.002	Emotional	25,75	10,43	15,33	NS
GH	49,33	79,11	29,78	0.01					
VT	68,33	75,83	7,5	0.02					
General anaesthesia									
General	55,67	74,18	18,51	0.002	General	22,54	14,21	8,33	0.02
PF	39,41	63,67	24,26	0.02	Mobility	11,67	8,13	3,54	NS
RP	70,46	71,55	1,09	NS	Energy	31,24	15,78	15,46	NS
SF	64,93	89,99	25,06	0.003	Sleep	11,35	6,07	5,28	NS
RE	52,78	81,34	28,56	0.001	Pain	48,67	31,28	17,39	0.002
MH	56,78	71,66	14,88	0.02	Isolation	1,52	0	1,52	NS
BP	35,73	50,27	14,54	0.03	Emotional	27,65	9,87	17,78	NS
GH	48,56	80,46	31,9	0.01					
VT	69,44	77,12	7,68	0.02					

Intergroup changes not significant. SF-36, Short Form-36; NHP, Nottingham Health Profile; Pre, preoperative; Post, postoperative; PF, physical functioning; RP, role physical; SF, social functioning; RE, role emotional; MH, mental health; BP, bodily pain; GH, general health; VT, vitality.

the end of each procedure and favoured by positive pressure administered by means of a 'to-and-fro' valve in the LA group. A temporary 10 Fr thoracic drain was left in place and connected to mild suction while the patient's position was changed to approach the other side. Once the left procedure was complete the right thoracic drain was removed and lung re-expansion video-controlled on left side as well. No further drain was inserted and the patient was transferred straight to the service after a 1-hour surveillance period and discharged the same day once a routine postoperative chest roentgenogram had excluded the presence of residual pneumothorax. Health status immediately before and 6 months after surgery was evaluated in both groups by the Short Form 36 (SF-36) and the Nottingham Health Profile (NHP) questionnaires [9,10]. These questionnaires were chosen due to their relative simplicity and availability into validated version for the Italian population [11,12]. Furthermore, patient's satisfaction with the operation (discomfort, fear, intraoperative and postoperative pain, cough) was assessed by asking to choose one out of five possible responses, where applicable: very poor, poor, good, very good, excellent (scored 1–5).

3. Results

No operative mortality was recorded. Global 'in operating room' time for the whole bilateral procedure was 63.55 ± 10.58 (range 47–85) under LA vs. 86.05 ± 5.75 (range 77–96) under GA. No patients in both groups required conversion into open procedure due to pleural adhesions or intraoperative bleeding. In eight patients (three LA and five GA), very thin adhesions were encountered that could be easily eliminated by electrocautery. A raise in hand temperature was documented in both groups of patients from a baseline of 25.42 ± 0.56 upto 32.15 ± 0.84 °C ($P=0.001$). In none of the patients in the LA group supplementary medication was required to control pain. Haemodynamic and gas exchange were well maintained throughout the procedure. Immediate relief of symptoms was obtained in all patients with an excellent degree of satisfaction manifested by a warm and dry hand. All patients undergone LA were discharged the same day after a chest roentgenogram and a short stay in the outpatient clinic. Among them three patients (20%) experienced a slight (<30%) pneumothorax that required no treatment. Patients in the GA group were discharged after a mean stay of 1.38 ± 0.6 days.

Pathology confirmed the presence of sympathetic ganglia in all specimens. At a mean follow-up of 7.16 ± 2.97 months, all patients in both groups showed a significant improvement in quality of life (QOL) after procedure while intergroup comparison showed no difference between LA and GA (Table 2). Patient's satisfaction evaluated by a direct interview 24 h after procedure was significantly higher in the LA group (Table 3). Late complications in these patients included interscapular pain ($n=4$, 26.6%) lasting for a mean time of 9 days (range 4–19) and serious compensatory posterior sweating ($n=2$, 13.3%) that resolved spontaneously at 6 months. As far as the GA group was concerned, eight patients (26.6%) had prolonged trunk compensatory sweating that did not persist longer than 4 months. Long-term resolution of palmar hyperhidrosis was complete in 100% of patients. No recurrence was observed.

Table 3
Patient's satisfaction 24 h after surgery for hyperhidrosis with concern to the type of anaesthesia: local (LA) vs. general anaesthesia (GA)

Degree of satisfaction	LA ($n=15$)	GA ($n=30$)	*P*-value
5—Excellent	11 (73.3%)	16 (53.3%)	
4—Very good	2 (13.3%)	6 (20%)	
3—Good	2 (13.3%)	4 (13.3%)	
2—Poor	-	2 (6.6%)	
1—Very poor	-	2 (6.6%)	
Mean score	4.6	4.0	<0.03

Table 4
Cost comparison between thoracoscopic sympathectomy under local (LA) and general anaesthesia (GA) for each procedure (currency unit = Euro)

Item	LA	GA	*P*-value
Orotracheal tube	-	12	<0.05
Drugs	124.98±53.22	581.65±93.74	<0.01
In operating room time	953.25±158.7	1290.75±86.25	<0.01
Medical personnel	84.72±13.96	127.08±20.94	<0.05
Hospital stay	310	427.8±1.86	<0.05

A cost analysis comparing LA to GA revealed a statistically significant advantage for LA group (Table 4).

4. Discussion

Since the introduction of video-assisted thoracic surgery in the early 1990s and as a result of improved telescopes and video imaging technology, thoracoscopic sympathectomy has become a standard therapy for hyperhidrosis worldwide. Thoracoscopic cervico-dorsal sympathectomy for primary palmar hyperhidrosis is performed by different ways depending on each surgeon's preference [7,8]. Many surgeons, as in our series, limit their resection to T2–T3 ganglia in order to prevent any risk for Horner's syndrome and/or compensatory sweating, while some others extend resection to the lower part of stellate ganglion to severe those fibres going to the upper extremity for a more complete treatment [3,6,13]. As far as the type of anaesthesia is concerned, this type of procedure usually requires single-lung ventilation to collapse the lung under general anaesthesia even though more recently some authors have slowly discontinued the use of double-lumen tubes in favour of simple orotracheal catheters [14]. However, thoracoscopic sympathectomy is mainly performed for social and aesthetic reasons and patient's compliance may be affected by the risks of general anaesthesia itself and single-lung ventilation when applied.

The mandatory surgical requirement for thoracoscopy and/or video-assisted thoracic surgery is to prevent lung from intruding into the operative field and achieve a good view of what is inside the thorax. This is naturally achieved in most instances by the pneumothorax that takes place when intrapleural and atmospheric pressure equilibrate through access ports unless there are pleural adhesions. Maintaining the subsequent collapse of ipsilateral lung is usually achieved by the technique of one-lung ventilation (OLV). This will normally allow access to the thorax by minimizing obstruction to the surgeon's view and field by lung yet dealing with the competition between surgical expediency and patient's blood gas homeostasis and haemodynamics. As a matter of fact, a greater degree of pulmonary collapse follows OLV and the non-ventilated lung becomes further compressed by absorption atelectasis. Moreover, the use of 100% inspired oxygen washes out nitrogen support and promotes an alveolar environment that improves absorption.

In theory, OLV with the non-ventilated lung open to the atmosphere such as with an endobronchial blocker is the most complete in terms of lung collapse and the most convenient for surgery; however, most popular OLV techniques are performed by lung separators and cessation of ventilation on the operated side.

The physiological consequences of ceasing to ventilate one lung are well known [15,16]. The majority of them relate to pneumothorax, the use of intermittent positive-pressure ventilation (IPPV) and the adoption of a lateral decubitus position. Physiological trespass of this degree causes an increase in shunt fraction and right ventricle work. The evidence for shunt fraction changes is based on arterial oxygen uptake and pulse oximetry. There is an increase when there is no background pulmonary pathology as co-morbidity, when the right lung rather than the left one is collapsed and in the younger population. All these three conditions take place in patients with primary palmar hyperhidrosis. Moreover, lung re-expansion is another factor that increases shunt fraction [16].

Sympathectomy is probably the most common procedure conducted thoracoscopically, the main indication being primary palmar hyperhidrosis. Therefore, most of the patients are fit and healthy, young or even adolescents, and the size of shunt fraction may be significant. As a matter of fact younger patients' reactions to hypoxia-mediated stimuli are less adapted to protect against ventilation/perfusion imbalance than those with cigarette-smoking related lung disease, and because of the operating position. Patients are usually placed supine (Inderbitzi's position) with arms outstretched to allow access to the axillary region for ports. This position negates gravity that is one of the main natural protective mechanisms from shunt fraction increase which is significant when lateral decubitus position is assumed. Moreover, it adds to the reduction of the functional residual capacity due to the displacement of the diaphragm in the supine position. Based on such considerations a thoracoscopic operation under local anaesthesia in a selected series of patients is safer and best tolerated. To our knowledge while many authors have tried different approaches to the spine and reduced the number of ports [13,17,18], no report has dealt with the use of local anaesthesia in thoracoscopic sympathectomy for primary palmar hyperhidrosis. Even in a recent review by Ojimba and Cameron [19], no mention is made on the use of local anaesthesia for this type of surgery and only recently a technique of selective lobar collapse has been described for various thoracoscopic procedures that might reduce the side effects of general anaesthesia in selected patients [20].

All of our patients maintained spontaneous breathing and the surgeon could achieve a satisfactory view from the half-deflated lung for his thoracoscopic operation. Patients received no sedative medication or intravenous analgesic agents throughout the procedure and supplementary oxygen was administered by means of a facemask only sporadically. Reverse Trendelenburg and rotation of the patient toward the side of surgery to achieve a semi-prone position for each side/procedure with the ipsilateral arm abducted provided an excellent exposure of the surgical field allowing the lung to move toward the surgeon who gained a good control of the spine. Since all patients undergoing local anaesthesia had been made aware of the possible discomfort that they could experience during the procedure, their cooperation was excellent. Namely they limited their movements and controlled their cough whenever present.

None of the patients in the LA group required a switch to GA during procedure nor any of them regretted having the procedure under LA. The pain was never a remarkable problem since we minimised the use of local electrocautery, especially on rib periostium, also to decrease the intensity of possible postoperative upper back pain. The successful transection of the sympathetic trunk was ascertained by the intraoperative control of hand temperature by a finger probe as already described [21]. Needless to say that the surgeon himself feels an increased level of stress while operating on an awake patient, but this was not a problem for any of the performed procedures in our series.

We used the most widely adopted two port technique since it enables a quick and effective procedure and a low rate of perioperative and postoperative complications with good aesthetic result as well [3,5]. The introduction of the first trocar was always preceded by dissection down to pleura with Metzenbaum scissors in order to make sure that no adhesions were present. Once the pneumothorax had been created the second trocar would be introduced. We normally use flexible trocars to minimise intercostal trauma and risk of lung tissue lesions. Moreover, this type of trocars enables the surgeon to introduce endoscopic instruments coaxially to the camera whenever necessary throughout the procedure. We do believe that downsizing trocars to 5 mm significantly diminishes postoperative pain even compared to a single 12 mm trocar as reported by others [13]. The use of CO_2 insufflation undoubtedly enhances visualisation by displacing the lung and expediting the procedure; however, the report of serious complications has prevented us from using this type of aid [3, 22]. Performing thoracoscopic sympathectomy on an awake patient did not cause any major problems to the surgeon except for the need of stopping and waiting when the patient would cough. Lung re-expansion was favoured by positive pressure administered by means of a 'to-and-fro' valve and controlled by telescope at the end of each procedure. We preferred to leave a temporary 10 Fr thoracic drain connected to mild suction in place for the first procedure while performing the other side and remove it at the end when also the left lung had regained its place. This would make pneumothorax more tolerable to our patients and ensure that at least on one side there was a full lung re-expansion. We agree that the elimination of postoperative chest drainage has proven to be safe and less painful and expedites recovery. Any residual pneumothorax or intrathoracic air leak can be easily managed by a catheter placed to a Heimlich valve [6].

Compensatory sweating is greater with T2–T4 resection than with T2 or T3 only or T2–T3 resection [5]. Limiting transection to T2–T3 segment has prevented us from having a significant proportion of patients with severe compensatory sweating and this type of complication was only a minor - inconvenience compared to their preoperative symptoms even if some authors argue that limited sympathectomy does not reduce the incidence and severity of this complication [23].

Thoracoscopic sympathectomy can be performed by different surgical and anaesthesiological techniques yet the degree of patient's compliance and satisfaction for such a procedure must be taken into account. Giving the patient the chance of achieving both functional and - aesthetic results with minimal risk and discomfort together with an excellent postoperative quality of life is the gold standard [4,5]. Outpatient thoracoscopic limited sympathectomy under general anaesthesia and a single-lumen endotracheal intubation for palmar hyperhidrosis is a well-established procedure [24], yet complications related to general anaesthesia cannot be underestimated. Moreover, quite a few patients do prefer not to sleep during minimally invasive surgical procedures and strongly ask to stay awake. This is why we selected this small yet significant group of patients to try this procedure under local anaesthesia.

Our group has already demonstrated the feasibility of video-thoracoscopic resection of solitary lung nodules in awake patients [25]. We believe that awake one stage, two port, bilateral thoracoscopic sympathectomy on an outpatient basis is a feasible procedure in selected patients and certainly the best compromise to gain the maximum patient's satisfaction and reduce the incidence of complications for the surgical treatment of a dismantling yet non-life-risk disease.

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Appendix A. Editorial comment

Awake one stage bilateral thoracoscopic sympathectomy for palmar hyperhidrosis: a safe outpatient procedure

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Thoracoscopic sympathectomy remains a controversial procedure. This relates to the precise indications and patient selection for the procedure, the approach by thoracoscopy using 1, 2 or 3 ports or by a small axillary thoracotomy, the technique and extent of ablation of the sympathetic trunk and the treatment of communicating branches, especially to avoid complications as compensatory truncal hyperhidrosis or Horner's syndrome. In this manuscript the authors add another controversial issue: whether or not the procedure is feasible under local anaesthesia as an outpatient procedure.

A provocative, novel and original series of 15 patients undergoing awake one stage bilateral thoracoscopic sympathectomy under local anaesthesia and spontaneous breathing is described. After a short stay in the outpatient clinic, these 15 patients were discharged the same day. This group is compared to 30 patients having the same intervention under general anaesthesia. Median age was 28.1 years in the group operated under local anaesthesia and 29.4 years in the general anaesthesia group. In both groups no conversion to thoracotomy was necessary. After a mean follow-up time of 7.16 months both groups had an improvement in the quality of life without any difference between both anaesthesia techniques. Cost analysis showed an advantage for the group operated under local anaesthesia. By performing the procedure under local anaesthesia in a patient who is breathing spontaneously, the authors state that the disadvantages of single lung ventilation are avoided. However, no mention of complications due to single lung ventilation is made in the 30 patients undergoing general anaesthesia and one-lung ventilation. The mean operating room time for the whole bilateral procedure under local anaesthesia was 64 versus 86 min in the group undergoing general anaesthesia. In a recent study, 176 patients underwent thoracoscopic sympathectomy via a transaxillary single-port approach and one-lung ventilation [1]. In this study, the operating time for one side was only 9 min and for both sides less than 20 min. So, it is questionable whether single lung ventilation is really harmful in these patients.

Although this is a consecutive series of patients undergoing thoracic sympathectomy for palmar hyperhidrosis, it is not clear how patients were precisely selected for this procedure. How many patients were evaluated but excluded afterwards? Due to a potential selection bias, results of this non-randomised study should be interpreted with caution. Whether this technique is feasible for other indications as e. g. digital ulcerations in older patients with vasospastic or immunologic disorders with arteritis or occlusive arterial disease also remains to be determined.

The authors are to be commended for bringing this novel technique to our attention, showing that is it feasible to perform a thoracic sympathectomy under local anaesthesia in young patients with its possible advantages of rapid discharge and cost containment. However, its real clinical value and benefit need to be demonstrated in larger comparative studies.

Reference

[1] Georghiou GP, Berman M, Bobovnikov V, Vidne BA, Saute M. Minimally invasive thoracoscopic sympathectomy for palmar hyperhidrosis via a transaxillary single-port approach. Interact Cardiovasc Thorac Surg 2004; 3:437–41.

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Awake one stage bilateral thoracoscopic sympathectomy for palmar hyperhidrosis: a safe outpatient procedure

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