Thoracic sympathetic block by clamping for treatment of hyperhidrosis*

*Bloqueio por clipagem de gânglios simpáticos torácicos no tratamento da hiper-hidrose**

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Abstract: BACKGROUND - Videothoracoscopic for the treatment of hyperhidrosis is carried out by clamping of the sympathetic trunk, with a possibility for reversal in cases of intense compensatory sweating.
OBJECTIVE - To evaluate therapeutic success, satisfaction, and compensatory sweating in patients submitted to this technique.
METHOD - Prospective study in which 45 patients were divided into two groups. Group I: one patient with palmar hyperhidrosis and 20 patients with palmar and plantar hyperhidrosis submitted to a T3 block; Group II: four patients with axillary hyperhidrosis, two with axillary and palmar hyperhidrosis, two with axillary and plantar hyperhidrosis, and 16 with axillary, palmar, and plantar hyperhidrosis submitted to a block of T3 and T4.
RESULTS - In Group I, 95.2% of the patients had palmar and plantar hyperhidrosis, and in Group II, 66.7% had axillary, palmar, and plantar hyperhidrosis. For the palmar region, excellent or good results occurred in 95.3% of Group I and in 94.4% of Group II; in the plantar region, 40% of Group I and 44.5% of Group II presented good results; in the axillary region, 95.8% reported excellent or good results. In six months, 76.2% of Group I and 91.7% of Group II had experienced compensatory sweating, but intense compensatory sweating occurred in only three patients of Group II.
CONCLUSIONS - This treatment proved to be effective for the treatment of hyperhidrosis. At the end of six months, all patients from Group I and 95.9% of the patients from Group II were satisfied with the results.
Keywords: Hyperhidrosis; Sympathectomy; Thoracic surgery

Resumo: *FUNDAMENTOS – Bloqueio simpático videotoracoscópico no tratamento da hiper-hidrose é realizado por clipagem do tronco simpático, com possibilidade de reversão em casos de sudorese compensatória intensa.*
OBJETIVO – Avaliar sucesso terapêutico, satisfação e sudorese compensatória nos pacientes submetidos a essa técnica.
MÉTODO – Estudo prospectivo em que 45 pacientes foram divididos em dois grupos. Grupo I: um paciente com hiper-hidrose palmar e 20 com hiper-hidrose palmar e plantar submetidos a bloqueio de T3; Grupo II: quatro pacientes com hiper-hidrose axilar , dois com hiper-hidrose axilar e palmar, dois com hiper-hidrose axilar e plantar e 16 com hiperidrose axilar, palmar e plantar submetidos a bloqueio de T3 e T4.
RESULTADOS – No grupo I 95,2% dos pacientes tinham hiper-hidrose palmar e plantar, e no grupo II 66,7% tinham hiperidrose axilar, palmar e plantar. Na região palmar, resultados excelentes ou bons ocorreram em 95,3% do grupo I e em 94,4% do grupo II; na região plantar 40% do grupo I e 44,5% do grupo II apresentaram bons resultados; e na região axilar, 95,8% relataram resultados excelentes ou bons. Em seis meses, havia sudorese compensatória em 76,2% do grupo I e 91,7% do grupo II, mas a sudorese compensatória intensa ocorreu em apenas três pacientes do grupo II.
CONCLUSÕES – Esse tratamento foi eficiente para o tratamento da hiper-hidrose. Ao final de seis meses, todos os pacientes do grupo I e 95,9% dos pacientes do grupo II estavam satisfeitos com os resultados.
Palavras-chave: Cirurgia torácica; Hiper-hidrose; Simpatectomia

Received on November 10, 2005.
Approved by the Consultive Council and accepted for publication on April 22, 2006.
* Work done at the Service of Thoracic Surgery and Respiratory Endoscopy of the Hospital Universitário Cajuru of the Pontifícia Universidade Católica do Paraná and at the Service of Thoracic Surgery of the Santa Casa de Misericórdia de Curitiba - Curitiba (PR), Brazil.
Conflict of interests: None

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INTRODUCTION

Primary hyperhidrosis is a disease of unknown origin, with an incidence of 0.3% to 1%, characterized by excessive sweating and quantitative disproportion of sudoresis necessary for thermoregulation and body heat dissipation.[1,2]

Since there are no topical or systemic medications capable of satisfactorily resolving this condition, videothoracoscopic sympathectomy has become popular.[3-5] It is an effective surgical method for the treatment of hyperhidrosis and other disorders mediated by the sympathetic nervous system (reflex sympathetic dystrophy, chronic pancreatitis, and prolonged QT syndrome).

Other techniques have been described, such as the resection of sympathetic ganglia,6 electrocautery ablation, sectioning of the sympathetic trunk by sympathotomy,[8] utilization of CO_2 laser 2, and ultrasonic coagulation.[9] The incidence of compensatory sweating, however, has remained high, varying between 40.3% and 98%.[1,10,11] Most patients experience a mild form of the disease that generally affects the dorsum, gluteal region, inguinal region, or thighs. Nevertheless, an intense form may occur in a 10% to 40% of patients.[8,12] In order to reverse the operation in an attempt to diminish intense compensatory sweating, clamping of the sympathetic ganglion was proposed instead of its resection.[13] Seeking to afford an alternative to patients suffering from intense compensatory sudoresis, in this article we decided to study clamping of the T3 thoracic sympathetic ganglion in palmar hyperhidrosis and clamping of sympathetic ganglions T3 and T4 in axillary hyperhidrosis both isolated and associated with palmar hyperhidrosis.

PATIENTS AND METHOD

During the period from March 1st to December 22, 2004, forty-five previously healthy patients were prospectively studied; ages ranged from 14 to 36 years, and patients presented with palmar and or axillary hyperhidrosis with or without associated plantar hyperhidrosis.

Patients were divided according to the region of hyperhidrosis into two groups (Table 1). Group I, with 21 patients, had one individual with palmar hyperhidrosis (PH) and 20 with palmar and plantar hyperhidrosis (PPlH). Group II, with 24 patients, had four individuals with axillary hyperhidrosis (AH), two with axillary and palmar hyperhidrosis (APH), two with axillary and plantar hyperhidrosis (APlH), and 16 with axillary, palmar, and plantar hyperhidrosis (APPlH). After they had signed informed consent forms, patients from the two groups underwent sympathetic blockage by clamping guided by videothoracoscopy and were evaluated in pre- and post-operative time points regarding the procedure, therapeutic result, side effects, compensatory sweating (CS), and complications.

Patients were submitted to general anesthesia, intubated with a double-lumen orotracheal cannula (Carlens or Robert-Shaw), and monitored with pulse oxymetry, cardioscopy and capnography. A cushion of approximately 5cm was placed under the dorsal region, and the patient was secured to the surgical table at the anterosuperior iliac crests with a wide band of adhesive tape. The patient's arms were in abduction supported by another cushion to avoid damage to the brachial plexus, and the patient was placed in semi-sitting position with a 45º inclination. All operations began on the left side, with a non-ventilated ipsilateral lung in order to facilitate exposure of the sympathetic chain. After surgical drapes were positioned and fixed, an incision was made of approximately 6 mm extension in the submammary region over the anterior axillary line of the fourth or fifth intercostal space for the insertion of the optical piece. Another 6 mm incision was made in the axillary region, under the hairline and over the mid axillary line of the third or fourth intercostal space for instrument insertion. Parietal pleura was dissected, and the sympathetic chain segment was clamped merely in its trajectory over the rib. This procedure was repeated for each sympathetic chain ganglion to be clamped.

In Group I patients, sympathetic clamping was performed above T3 and above T4, which corresponds to a T3 block. In Group II patients, sympathetic trunk clamping was performed above T3, above T4, and above T5, which corresponds to a T3 and T4 block. Next, 10 mL of anesthetic, 5% ropivacaine HCl, was instilled directly through the axillary access into the pleural space. A number 16 nasogastric [NG] tube was inserted into the pleural space, with the external extremity immersed in bowl containing saline solution for lung reexpansion after ventilation. After air leakage had ceased, the tube was removed and the surgical

TABLE 1: Assessing the groups as to number

Group I	**N**	**%**
n = 21 (46.67%)		
Palmar hyperhidrosis (HP)	1	(2.22)
Palmar and plantar hyperhidrosis (PPlH)	20	(44.44)
Group II		
n = 24 (53.33%)		
Axillary hyperhidrosis (AH)	4	(8.89)
Axillary and palmar hyperhidrosis (APH)	2	(4.44)
Axillary and plantar hyperhidrosis (APlH)	2	(4.44)
Axillary, palmar and plantar hyperhidrosis (APPlH)	16	(35.56)
Total	45	(100)

wound was closed. Once the procedure was finished on the left side, it was repeated on the right side.

Follow-up was done at 7 days, 30 days, and 6 months after the operation, with evaluations of the post-operative period, therapeutic success, satisfaction with the results of surgery, presence of CS, and complications. Compensatory sweating was classified as absent, mild, moderate, or intense, with identification of the regions where it occurred. Mild CS was defined as the appearance of sweating in any area of the body, except those where the patient had hyperhidrosis, which did not stain clothing or cause the patient any nuisance / discomfort. Moderate CS was defined when the sweating stained clothing, but did not cause significant nuisance /discomfort to the patient. Intense CS was defined when besides staining clothing, sweating caused significant nuisance / discomfort or was incapacitating.

Therapeutic success was classified as excellent, good, regular, and poor. It was established that results considered excellent or good would be necessary in order to attain satisfactory or positive therapeutic success, and regular or poor results would be considered unsatisfactory or negative therapeutic success. 'Excellent' therapeutic success was defined when the patient did not experience sweating in the region of hyperhidrosis; 'good' was when there was a moderate improvement of the sweating, leaving the area damp, but with no discomfort to the patient; 'regular' was when the patient experienced a slight improvement; and 'poor' therapeutic success was when there was no improvement.

At 30-day and six-month follow-up after surgery, patient satisfaction or dissatisfaction was evaluated. At this time, the patient was asked it he/she felt satisfied or unsatisfied with the results of the surgical treatment. The first possibility would lead to the question of if the patient felt very satisfied or simply satisfied. 'Very satisfied' refers to the patient who felt completely satisfied, i.e., the patient obtained what he/she desired and at the time of the evaluation, showed extreme contentment with the result. 'Satisfied' refers to the patient who, for some reason, was not completely satisfied with the result. 'Unsatisfied' refers to the patient who demonstrated some degree of dissatisfaction with post-operative results. The degree of satisfaction was determined by means of a grade attributed by the patient, on a scale from zero to 10 (the more satisfied the patient, the higher the grade).

Thoracic pain was classified as mild, moderate, and severe. Pain was considered mild if it was experienced upon movement but did not debilitate the patient; moderate pain was continuous pain that occurred even when at rest and caused the patient limitations; and severe pain occurred in a very intense form, causing the patient debilitation and significant limitation.

Descriptive data analysis was used with figures organized in tables, graphs, and figures. Substantiation of the objective raised in this study was achieved using parametric Student's t tests (using Primer of Biostatistics software) and non-parametric chi-square, Fisher's exact, and Mann-Whitney tests (using Epi-Info). The level of significance (probability of significance) adopted was less than 5% ($p<0.05$).

RESULTS

Of the 45 patients between 14 and 36 years of age (mean age of 24 years), 9 (20%) were men and 36 (80%) were women; as to familial history, 16 (35.6%) had hyperhidrosis in the family. Age at onset of symptoms varied from one to 25 years. Of the 21 patients in Group I, one (4.8%) presented with PH and 20 (95.2%) with PPlH. Of the 24 patients in Group II, four (16.7%) presented with AH, two (8.3%) with APlH, two (8.3%) with APH, and 16 (66.7%) with APPlH (Table 1). In all, 39 (86.7%) patients experienced hyperhidrosis in the palmar region, 38 (84.4%) with an association of the plantar region, and 24 (53.3%) had axillary involvement. The most frequent worsening factor was stress (82.5%), followed by heat (65%), anxiety (20%), physical exertion (17.5%), cold (15%), and others (2.5%). Only three patients (14.3%) reported improvement factors (rest, exposure to low

TABLE 2: Complications

Complications	Group I		Group II		Total	
	N	%	N	%	N	%
No	20	95.2	21	87.5	41	91.1
Yes	01	4.8	03	12.5	04	8.9
Dificult intubation	-	-	01	4.2	01	2.3
Medium volume hemothorax	01	4.8	-	-	01	2.2
Paresia and right upper limb paresthesia	-	-	01	4.2	01	2.2
Grade I pneumothorax	-	-	01	4.1	01	2.2
Total	21	100	24	100	45	100

p = 0.357 (Fisher´s exact test).

temperatures (as during winter), or cold showers and hand washing).

Complications occurred in four (8.89%) patients (Table 2). In Group I, there was one case of a medium volume hemothorax in a patient with pleuropulmonary adhesions, which was resolved with closed thoracic drainage in 24 hours. Group II had one case of impossibility of intubation with a Carlens tube that was substituted for a common orotracheal tube, one case of paresthesia of the right upper limb that became asymptomatic in six months, and one case that required drainage during 24 hours because of an broad release of pleuropulmonary adhesions.

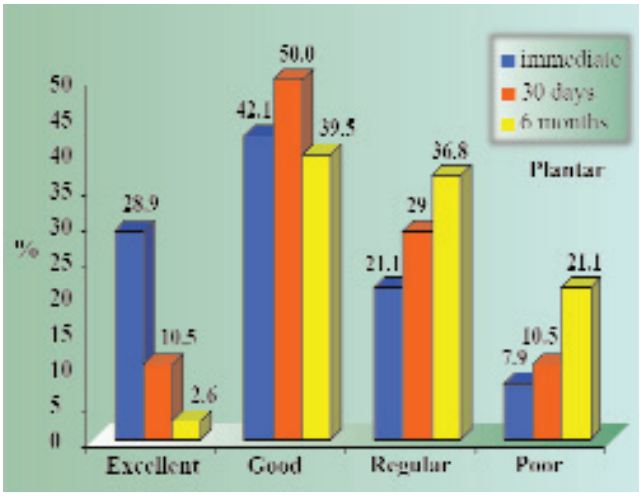
Thirty-nine (86.7%) patients presented hyperhidrosis in the palmar region, of whom 21 (46.7%) were from Group I, and 18 (40%) were from Group II. At seven days, 32 (82.1%) showed excellent results, and seven (17.9%), had good results. At 30 days, 31 (79.5%) had excellent results, and eight (20.5%), had good results. At six months, 33 (84.6%) presented excellent results; four (10.3%), experienced good results, and two (5.1%), had regular results (Graph 1).

Thirty-five (77.78%) patients had plantar hyperhidrosis; 20 (44.4%) of these were from Group I, and 18 (40%), were from Group II. At immediate follow-up, 11 (28.9%) had excellent results; 16 (42.1%), had good results; eight (21.1%) had regular results, and three (7.9%) experienced poor results. At 30 days, four (10.5%) showed excellent results; 19 (50%) had good results; 11 (29%) had regular results, and four (10.5%) had poor results. At six months, only one (2.6%) continued to show an excellent result; 15 (39.5%) had good results; 14 (36.8%) experienced regular results, and eight (21.1%) had poor results (Graph 2).

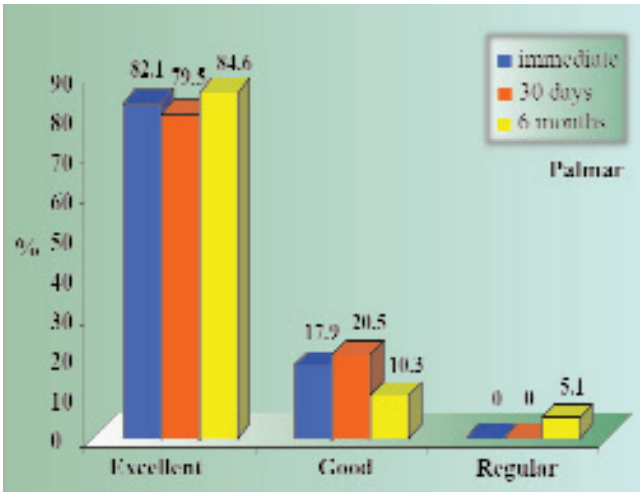
Twenty-four (53.3%) patients had axillary hyperhidrosis, and they represented Group II. At seven days, 15 (62.5%) had obtained excellent results, and nine (37.5%) had good results. At 30 days, 14 (58.3%) presented excellent results, and 10 (41.7%) had good results. At six months, 14 (58.3%) continued to show excellent results, nine (37.5%) had good results, and one (4.2%) only obtained a regular result (Graph 3).

At the immediate follow-up (Table 3), 23 (51.1%) patients developed CS, eight of them (38.1%) from Group I and 15 (63.5%) from Group II (p = 0.182). At 30 days, 30 (66.7%) had CS, 12 (57.1%) from Group I, and 18 (75%) from Group II. At six months, 38 (84.4%) had CS, 16 (76.2%) of them from Group I, and 22 (91.7%) from Group II. In Group I, all cases of CS were mild to moderate in degree. In Group II, at immediate follow-up, all showed mild to moderate CS; at 30 days, three (8.55%) had intense CS, which persisted even at the six-month follow-up

Graph 2: Hyperhidrosis in relation to therapeutic success – Plantar



Graph 1: Hyperhidrosis in relation to therapeutic success – Palmar



Graph 3: Hyperhidrosis in relation to therapeutic success – Axillary

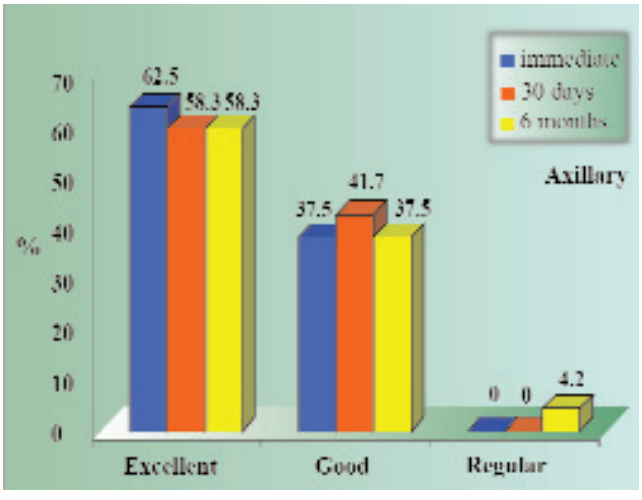


TABLE 3: Progression of compensatory sweating

Sweating	Group I		Group II		Total		*P* value
	N	%	N	%	N	%	
Immediate	21	100	24	100	45	100	0.182 [1]
No	13	61.9	09	37.5	22	48.9	
Yes							
Mild	06	28.6	10	41.7	16	35.6	
Moderated	02	9.5	05	20.8	07	15.5	
30 Days	21	100	24	100	45	100	0.342 [1]
No	09	42.9	06	25	15	33.3	
Yes							
Mild	05	23.8	10	41.7	15	33.3	
Moderated	07	33.3	05	20.8	12	26.7	
Intense	-	-	03	12.5	03	6.7	
6 Months	21	100	24	100	45	100	0.155 [2]
No	05	23.8	02	8.3	07	15.6	
Yes							
Mild	07	33.3	12	50	19	42.2	
Moderated	09	42.9	07	29.2	16	35.5	
Intense	-	-	03	12.5	03	6.7	

(1) Chi-square test
(2) Fisher's exact test

(Graphs 4 and 5) and affected primarily the dorsum, abdomen, and thorax.

The grade given to the degree of satisfaction at 30 days in both groups varied from six to 10 (average of 9.4); the average grade for Group I was 9.5, in which 19 patients (90.4%) were very satisfied with the results of the operation, one (4.8%) was satisfied, and one (4.8%) was dissatisfied (Chart 1). For Group II, the average grade was 9.3, including 22 (91.7%) 'very satisfied' patients, two (8.3%) 'satisfied' patients and no patient was 'dissatisfied'. At six months, the grade varied from five to 10 (average of 8.9); Group I had an average grade of 9.1, in which 17 (81%) patients were 'very satisfied', and four (19%) were 'satisfied' with the results of surgery. In Group II, the average grade was 8.7. In this group, 16 (66.7%) were 'very satisfied', seven (29.2%) were 'satisfied', and one (4.1%) was 'dissatisfied' (Graph 6).

DISCUSSION

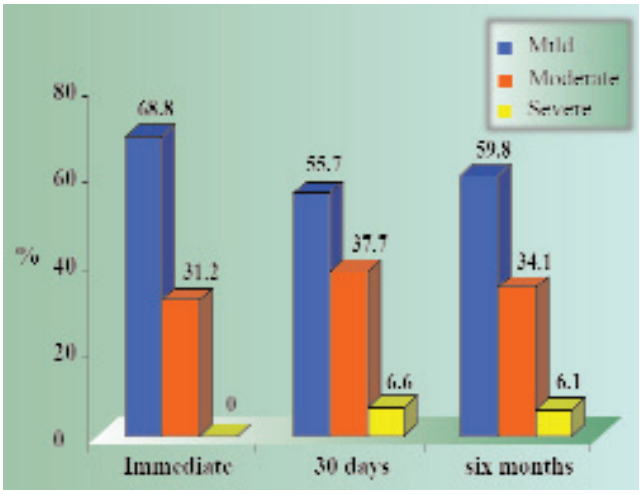
The female gender predominated, both in Group I (76.2%) and in Group II (83.3%), which concurs with medical literature in which 60 to 73% of all cases appear in women, especially those of Asian origin.[2,14-18] Hyperhidrosis is a disorder that can cause embarrassment and even disable a person, both socially and professionally. After analysis of several studies, predominance of cases in women was evident.[19-21] In this series, we believe that this predominance occurred because women experience more embarrassment with this abnormality, and are therefore more apt to seek surgical treatment.

Age varied from 14 to 36 years (mean of 24 years). In literature, the average age at which surgery was performed ranged from 14.1 to 31 years.[18,20,22,23] Onset of symptoms was more premature in Group I (mean of five years) than in Group II (mean of 6.5 years), but with no significant difference. Hyperhidrosis tends to appear in adolescence in men and in childhood in women.[24-27]

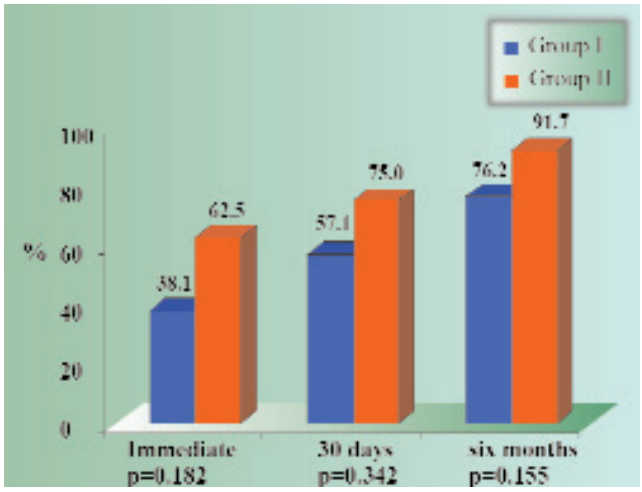
The presence of a positive family history was similar in both groups, noted as 35.6% of cases. In literature, the familial relation is not evident, and is present in a percentage that varies from 12.5 to 56.1%.[2,7,26,28]

Worsening or trigger factors for symptoms

GRAPH 4: Degree of compensatory sweating



Graph 5: Presence of compensatory sweating in the groups studied



were present in 88.9% of cases, with similarities between the two groups; among these, stress was the most common trigger (82.5%). The association between these factors and hyperhidrosis is frequent, e.g., thermal stimuli, causing effects especially on the trunk and head. In spite of also being vulnerable to the effects of temperature, palmar and plantar hyperhidrosis are mostly considered related to emotional stimuli (anxiety and stress). Androgenic factors may increase the activity of sudoriparous glands in men.[10,26] Improvement factors, such as rest or exposure to milder temperatures, were present in 14.3% of cases in Group I and in 12.5% of Group II. There was no citation in literature regarding this observation.

Isolated PH was only found in one case, while most patients (95.2%) from Group I presented with PPlH. In Group II, isolated AH was only identified in four patients (16.7%). Data presented in literature do not make it clear if PH or AH appear more frequently as isolated entities or in association one with one another or with the plantar form, but there is a tendency towards a greater occurrence of the combined form.[20-23] This leads to a reflection as to the possibility of some patients not becoming satisfied with the results of the operation, since results in the plantar region are inferior to those of the palmar region. At the preoperative evaluation, we tried to make it very clear to all patients that surgery would be performed in order to improve sudoresis of the palmar and axillary region, and that there might or might not be an improvement of the plantar region.

In examining complications related to surgery, in Group I there was one case of hemothorax (4.8%), and in Group II there was one case of difficult intubation, one case of paresia of the right brachial biceps and paresthesia of the right upper limb, and one case of pneumothorax, totalizing 12.5% of complications in Group II. Considering Groups I and II, the total of complications was 8.9%. Severe complications such as recurrence of symptoms, Claude Bernard-Horner syndrome, chylothorax, and hemothorax are uncommon, present in about 1.8%[1,17] of cases and did not appear in this series.

Incidence of thoracic pain was 25 (55.6%) cases, similar in both groups. Most of these experienced mild thoracic pain, and only one case (2.2%) had severe chest pain for one week, a finding similar to what is reported in literature.[6,7,18] Patients may experience intercostal neuritis pain because of parietal pleura manipulation and costal periosteum electrocoagulation during dissection of the sympathetic trunk along its trajectory over the rib. Intercostal neuralgia possibly occurs because of trauma caused by handling along the intercostal space. For a correct identification of the sympathetic trunk to be clamped, the parietal pleura over the costal arch needs to be opened, and some times during this dissection, the periosteum is damaged by the electrocautery, which can lead to pain.

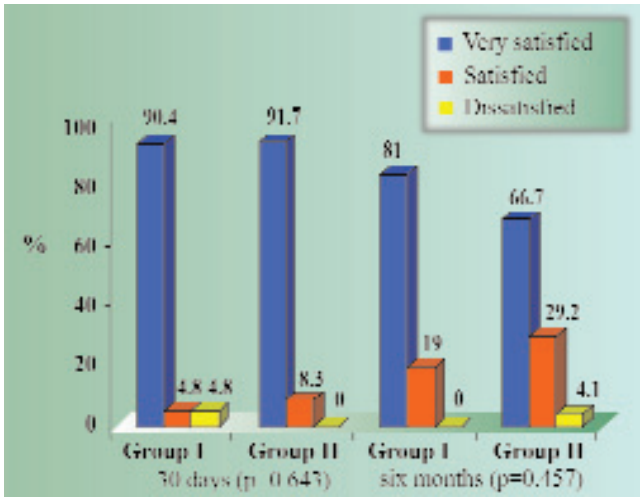
In palmar hyperhidrosis, whether isolated or associated to the plantar form (Group I) or to the axillary form (Group II), results were excellent or good for all patients at the immediate follow-up and at 30 days. At six months, there was one (4.7%) case in Group I with a result considered regular and one (5.6%) case of a regular result for palmar hyperhidro-

Chart 1: Degree of satisfaction (grade) in the groups studied

Degree of satisfaction	N	Mean	Standard deviation	Minimum	Maximum	p value(1)
30 Days	45	9.4	0.9	7	10	0.512
Group I	21	9.5	1	7	10	
Group II	24	9.3	0.9	7	10	
6 Months	45	8.9	1.2	5	10	0.284
Group I	21	9.1	1.1	7	10	
Group II	24	8.7	1.2	5	10	

(1) Student's *t* test

GRAPH 6: Degree of satisfaction



sis in Group II. Results of plantar hyperhidrosis, whether associated or not to palmar or axillary hyperhidrosis, were similar at 30 days and at six months. The mechanism by which plantar hyperhidrosis improves is not known. In this series, we noted that at the six-month follow-up, patients submitted to the T3 block presented results similar to those submitted to the T3 and T4 block (p = 0.959), which lead to the conclusion that the improvement is not related to the extension of ablation. Some studies show that sympathectomy for axillary hyperhidrosis produces results inferior to when it is performed for plantar hyperhidrosis, since many consider the former to be a discrete clinical entity since it involves a combination of eccrine and apocrine glands in the axillary region. Eccrine glands are affected by a sympathectomy but apocrine glands are not blocked by this type of surgery as they respond primarily to epinephrine.[22,24,25,29]

As to satisfaction, Group I showed a decline in the number of 'very satisfied' patients from the 30-day to the six-month follow-up. However, at the 30-day follow-up, one (4.8%) patient reported being dissatisfied, and at the six-month follow-up, all patients reported being 'very satisfied' or 'satisfied'. In Group II, at the end of six months, 95.9% of patients reported being 'very satisfied' or 'satisfied', and one (4.1%) reported feeling 'dissatisfied'. In medical literature, between 72% and 94% of patients are satisfied with the results of the operation.[4,10,17,27,30] As to techniques, all patients treated with the clamping method tended to become more satisfied.[23]

Incidence of CS was greater in Group II. The most frequent location for CS in Group I was the abdomen, while in Group II it was the dorsal region. At the end of six months, 84.4% of patients presented with CS, but only three (6.7%) were intense. Incidence of CS in literature is 32% to 86%, and as an intense form in 2% to 8%. It primarily affects the dorsum (63%), thighs (32%), and thorax (31%).[7,22,27,28,30] Two of the three patients with intense CS reported being 'very satisfied', while the other patient stated he was 'satisfied', explaining that the only reason he was 'satisfied' and not 'very satisfied' was the fact of not having felt an improvement of sweating in the plantar region. Clamping seems to be an attractive alternative for treatment of palmar and axillary hyperhidrosis, since it affords the patient the option of a reversal of the operation, especially for those who experience intense CS. However, analyses of the results of reversal are very superficial, and studies that are more comprehensive are necessary on the removal of clamps.

CONCLUSIONS

Sympathetic blockage by clamping of T3, and of T3 & T4 was effective in the treatment for palmar and axillary hyperhidrosis.

As to clinical progress, results were excellent or good for all patients at the immediate and 30-day follow-ups. After six months, there was one case (4.7%) of a regular result in Group I and one case (5.6%) in Group II.

All patients in Group I and 95.9% of patients in Group II were satisfied with the results obtained, regardless of the level of ganglion blockage.

Complications occurred in 8.9% of patients, but they were transitory and did not affect the results of treatment.

The high rate of compensatory sweating was independent of the level of sympathetic blockage and did not determine the patients' level of dissatisfaction.❑

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