Original Article

The incidence of residual pneumothorax after video-assisted sympathectomy with and without pleural drainage and its effect on postoperative pain*

Incidência de pneumotórax residual após simpatectomia torácica videotoracoscópica com e sem drenagem pleural e sua possível influência na dor pós-operatória

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Abstract

Objective: To determine the incidence of residual pneumothorax after video-assisted thoracic sympathectomy, with and without postoperative pleural drainage, and to evaluate the possible influence of this type of pneumothorax on postoperative pain within the first 28 postoperative days. **Methods:** All patients presenting symptoms consistent with primary palmoplantar hyperhidrosis and treated at the Thoracic Surgery Outpatient Clinic of the State Hospital of Sumaré between July and December of 2006 were included. All were submitted to sympathectomy up to the third ganglion using video-assisted thoracoscopy and were randomized to receive or not receive postoperative pleural drainage for 3 h. Chest X-rays and low-dose computed tomography scans of the chest were performed on the first postoperative day in order to determine the incidence of residual pneumothorax. At different time points up to postoperative day 28, patient pain was assessed using a visual numeric scale and by measuring the quantity of opioid analgesics required. **Results:** This study comprised 56 patients, 27 submitted to bilateral pleural drainage and 29 not submitted to drainage. There was no statistical difference between the two groups in terms of the incidence of post-sympathectomy residual pneumothorax. Residual pneumothorax diagnosed through any of the methods did not influence pain within the first 28 postoperative days. **Conclusion:** Performing closed pleural drainage for 3 h immediately after video-assisted thoracic sympathectomy did not affect lung re-expansion or the incidence of residual pneumothorax. When residual pneumothorax was present, it did not affect pain within the first 28 postoperative days.

Keywords: Hyperhidrosis; Sympathectomy; Pain, postoperative; Pneumothorax; Drainage; Pleura.

Resumo

Objetivo: Avaliar se o pneumotórax residual após simpatectomia torácica videotoracoscópica tem incidência diferente quando utilizada a drenagem pleural pós-operatória ou não e se este pneumotórax residual, quando presente, pode influenciar a dor pós-operatória até o 28º dia. **Métodos:** Foram incluídos todos os pacientes com queixa de hiperidrose palmoplantar primária atendidos no Ambulatório de Cirurgia Torácica do Hospital Estadual Sumaré, de julho a dezembro de 2006. Todos foram submetidos à simpatectomia do terceiro gânglio torácico por videotoracoscopia e aleatorizados para receber ou não drenagem pleural pós-operatória por 3 h. Todos foram avaliados no pós-operatório imediato com radiogramas de tórax e tomografia computadorizada de tórax de baixa emissão de energia para detecção de pneumotórax residual. Foram avaliados quanto à dor pós-operatória em diferentes momentos até o 28º dia de pós-operatório, por meio de escala numérica visual e dosagem requerida de analgésicos opióides. **Resultados:** Foram incluídos 56 pacientes neste estudo, 27 com drenagem pleural bilateral e 29 sem drenagem pleural. Não houve diferença estatística entre a incidência de pneumotórax residual após simpatectomia com e sem drenagem pleural. O pneumotórax residual, quando presente e diagnosticado por qualquer um dos métodos, não influenciou a dor pós-operatória até o 28º dia. **Conclusão:** Concluiu-se que a drenagem pleural tubular fechada, por um período de 3 h, no pós-operatório imediato de simpatectomia torácica videotoracoscópica, foi tão eficiente quanto a não drenagem, em relação à reexpansão pulmonar e à presença de pneumotórax residual. O pneumotórax residual, quando presente, não interferiu na dor pós-operatória até o 28º dia.

Descritores: Hiperidrose; Simpatectomia; Dor pós-operatória; Pneumotórax; Drenagem; Pleura.

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Introduction

Hyperhidrosis, or excessive sweating, has gained notability among physicians and lay people since the advent of thoracic sympathectomy. It is a disease with an estimated incidence of 1% in the general population and a prevalence of 2.8%.[1-4] However, in the last two decades, discussions regarding hyperhidrosis have become more in-depth. Hyperhidrosis can be classified as either primary or secondary and can be either localized or generalized, all of which affects the treatment.[1,5]

For the treatment of localized primary hyperhidrosis, video-assisted thoracic sympathectomy is a rapid, safe and efficacious procedure that is quite well accepted by physicians and patients alike. Although complications are rare,[1] they can include pneumothorax, hemothorax, bleeding, paresthesia, compensatory hyperhidrosis, chronic pain, atelectasis, pneumonia, chylothorax and Claude Bernard-Horner syndrome, among others.

Despite the simplicity and rapidity of the procedure, some patients experience intense, in some cases persistent, postoperative pain.[6,7]

Knowing that the presence of air in the pleural cavity is a potential pain stimulus, this study was designed in order to determine the real incidence of residual pneumothorax after video-assisted thoracic sympathectomy, with and without postoperative pleural drainage, and to evaluate the possible influence of this type of pneumothorax on postoperative pain within the first 28 postoperative days.

Methods

All patients presenting symptoms consistent with primary palmoplantar hyperhidrosis and treated at the Thoracic Surgery Outpatient Clinic of the State Hospital of Sumaré between July and December of 2006 were included in this study.

The exclusion criteria were presenting firm, disseminated pleuropulmonary adherences and requiring pleural drainage, for any reason, that exceeded the 3 h of drainage determined by the protocol.

The operation performed was always performed by the same surgeon and was always the same: bilateral sympathectomy via video-assisted thoracoscopy, with complete dissection and excision, using electrocautery and endoscopic scissors, up to the third ganglion of the sympathetic thoracic chain, with bilateral internal intercostal blockage of the second to fifth intercostal space.

The anesthesia session and the preoperative, intraoperative and postoperative immediate analgesia (Chart 1) were standardized. All anesthesia sessions were performed by the same anesthesiologist.

At the moment of the surgical procedure, patients were randomized, using a sealed manila envelope, to receive bilateral closed pleural drainage, using an 18 F tube, or to be submitted to water-sealed lung re-expansion using a #14 urethral tube placed in the pleural cavity, during Valsalva maneuvers (assisted pulmonary insufflation maintained by the anesthesiologist). In patients submitted to postoperative water-sealed pleural drainage, the drains were removed 3 h into the postoperative period, while the patients were still in the postanesthesia care unit (PACU) of the surgery center, provided there were no air leaks, great fluctuations or bleeding.

After being discharged from the PACU, all patients were submitted to lateral chest X-rays while inhaling, anteroposterior chest X-rays while inhaling and while exhaling, as well as to low-dose computed tomography scans of the chest (60-100 mA, 80-120 kV, 1 s exposure) and only six

Chart 1 - Standardization of medication used in the anesthesia session, as well as for in-hospital and take-home analgesia.

Pre-anesthesia drugs, together with drugs used for the induction and maintenance of anesthesia	Midazolam
	Alfentanil
	Propofol
	Atracurium or rocuronium
	Ketoprofen
	Sodium dipyrone
	Dexamethasone
	Internal intercostal blockage under direct under direct viewing with 0.25% bupivacaine and adrenaline
	Tramadol
Drugs used for in-hospital analgesia	Ketoprofen
	Dipyrone
	Tramadol
Drugs used for take-home analgesia	Ketoprofen (50 mg orally every 8 h for 5 days)
	Dipyrone (40 drops orally every 6 h for 7 days)
	Tramadol (50 mg orally every 6 h in case of pain)

tomographic slices – two at the thoracic entry, two at the level of tracheal carina and two in the lung base.

Postoperative pain was always assessed by the same physician of the anesthesiology team, who did not participate in the surgical procedure and did not have access to the information in the patient charts, through visual analog scale (VAS), at the following time points: after drain removal, in the PACU; during the immediate postoperative period, in the infirmary; and on postoperative days 7 and 28.

Data regarding characteristics and location of the pain were recorded. As to the characteristics of the pain, we can divide it into chest pain upon breathing, continuous, with inflammatory or mechanical rhythm. Regarding location, it was classified as retrosternal, posterior or at surgical trocar sites.

Postoperative take-home analgesia (Chart 1) was standardized and the quantity of opioid analgesics required was monitored up to postoperative day 28.

Data regarding resolution rates, the level of patient satisfaction with the sympathectomy, and the incidence/intensity of compensatory sweating, as well as complications of the procedure, were also recorded.

Statistical analyses were performed using the Epi Info statistical program, version 6.04d (Centers for Disease Control and Prevention, USA; World Health Organization, Switzerland).

This study was approved by the Ethics in Research Committee in accordance with the guidelines set forth in Ruling no. 122/2006, issued by the State University at Campinas School of Medical Sciences. All patients agreed to be submitted to the procedure, agreed to participate in the study and gave written informed consent.

Results

Of a total of 57 patients, 1 was excluded due to diffuse pleural adherences and for requiring more than 3 h of drainage. Among the 56 patients in the final sample, ages ranged from 10 to 49 years (mean 22.5 ± 1 years), 41 of whom were females (73.2%). There was no difference between the two groups (with and without pleural drainage) regarding these parameters (p = 0.47 and p = 0.45, respectively).

Surgical time ranged from 20 to 60 min (mean 40 ± 1.2 min), and there was no difference between the two groups (p = 0.16).

There were nine minor intraoperative complications that did not affect the result of the study: four cases of loose adherences located on the right; one case of a loose adherence located on the left; one case of mild bronchospasm after extubation; two cases of unsatisfactory lung collapses with a selective Robertshaw endobronchial tube; and one case of difficulty in the initial identification of the sympathetic chain in the left hemithorax. There was no difference between the two groups in terms of such complications (p = 0.80).

Bilateral postoperative pleural drainage was employed in 27 patients (48.2%), and no drainage was used in the remaining 29 patients (51.8%).

Anteroposterior chest X-ray in the orthostatic position, while inhaling, was absolutely normal in 18 patients (32.1%), and residual pneumothorax was detected in 17 patients (30.4%). When the patients were separated into two groups (those who had received drainage and those who had not), 25.9% (7 patients) and 34.4% (10 patients), respectively, presented residual pneumothorax, with no difference between the two groups (p = 0.48) (Figure 1). The additional alterations were laminar atelectasis and emphysema of the subcutaneous cellular tissue.

Chest X-rays in the orthostatic position, while exhaling, revealed residual pneumothorax in 39.3%

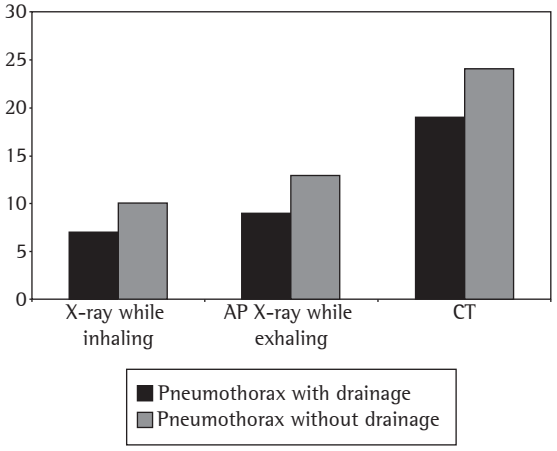

Figure 1 - Residual pneumothorax with and without pleural drainage. AP: anteroposterior; and CT: computed tomography (scan of the chest).

(22 patients) and was absolutely normal in 25% (14 patients). On the same X-rays, when patients were analyzed separately, residual pneumothorax was seen in 33.3% of the patients who had received drainage (9 patients) and in 44.8% (13 patients) of those who had not, with no difference between the two groups (p = 0.37) (Figure 1).

The low-dose computed tomography scans of the chest detected residual pneumothorax in 76.8% (43 patients). In the patients submitted to postoperative drainage, this rate was 70.3% (19 patients), compared with 82.7% (24 patients) in those without pleural drainage, with no difference between the two groups (p = 0.27) (Figure 1).

Therefore, the overall rate of occult pneumothorax (only visible through tomography), revealed on anteroposterior X-rays was 35.7% (20 patients): 48.2% while patients were inhaling and 41.1% while patients were exhaling.

The VAS score in the PACU ranged from 0 to 10, with a mean of 2.16 ± 0.35. Regarding characteristics, 44.6% of the patients reported chest pain upon breathing and 32.1% reported retrosternal pain. The same evaluation performed in the infirmary, during the immediate postoperative period, ranged from 0 to 10, with a mean of 3.75 ± 0.30, being 69.6% of chest pain upon breathing and 78.6% of retrosternal pain.

On postoperative day 7, according to VAS, pain ranged from 0 to 10, with a mean of 2.05 ± 0.31; regarding characteristics, it was continuous in 32.1% of the cases, and retrosternal in 26.8%. On postoperative day 28, pain ranged from 0 to 3, with a mean of 0.17 ± 0.08, 7.1% of mechanical rhythm and 5.4% upper posterior.

At no time was there any difference between the patients who had received drainage and those who had not or between those with residual pneumothorax and complete re-expansion diagnosed on tomography scans, on X-rays taken while inhaling or while exhaling, regarding the intensity of the pain during the period in the PACU, during the immediate postoperative period or on postoperative days 7 and 28 (Table 1).

The patients who were submitted to drainage reported more continuous pain in the immediate postoperative period (one in the group receiving drainage and seven in the group not receiving drainage, p = 0.01), with no difference in the intensity of the pain (p = 0.71).

Table 1 - Statistical significance of the differences in pain scores for the different groups studied.

Visual analog scale	PAC	IPO	PO7	PO28
Drainage *vs.* no drainage	p = 0.48	0.71	0.72	0.16
With pneumothorax diagnosed on CT *vs.* without	p = 0.28	0.63	0.70	0.64
With pneumothorax diagnosed on X-rays while inhaling *vs.* without	p = 0.19	0.77	0.84	0.25
With pneumothorax diagnosed on X-rays while exhaling *vs.* without	p = 0.20	0.56	0.70	0.53

PAC: postanesthesia care; IPO: immediate postoperative period; PO7: postoperative day 7; PO28: postoperative day 28; and CT: computed tomography (scan of the chest).

The quantity of opioid analgesics required (oral tramadol hydrochloride, 50 mg) ranged from 0-33 pills (mean 5.41 ± 1.05 pills) up to day 28, to 0-18 pills (mean 3.12 ± 0.62) up to day 7 to 0-23 pills (mean 2.26 ± 0.67) between days 8 and 28, with no difference between the groups that had received drainage or not, or between the groups with or without residual pneumothorax, diagnosed through tomography, or on X-rays taken while inhaling or exhaling (Table 2).

The resolution rate for palmar sweating was 100%. Plantar sweating presented some degree of response in 83.9% of the cases and was completely resolved in 26.8% (Figure 2).

As can be seen in Figure 2, the rate of compensatory sweating was 58.9% (in 33 patients, all of whom reported that it was mild or moderate and did not cause them any discomfort).

All of the patients reported being satisfied with the surgery, 98.2% would recommend it to a friend or relative, and 98.2% would undergo the surgery again (Figure 2).

There were no cases of Claude Bernard-Horner syndrome.

Discussion

Video-assisted thoracic sympathectomy is the most efficacious treatment for localized primary hyperhidrosis.[8-10] The level of patient satisfaction is related to the presence or absence of compen-

Table 2 - Statistical significance of the differences in the quantity of opioid analgesics required in the different groups analyzed.

	Total Tramadol required	Tramadol up to PO7	Tramadol from PO7 to PO28
Drainage *vs.* no drainage	4.3 ± 1.2	3.1 ± 0.8	1.2 ± 0.4
	6.3 ± 1.7	3.1 ± 0.8	3.2 ± 1.1
	p = 0.52	p = 0.20	p = 0.57
With pneumothorax diagnosed on CT *vs.* without	6.0 ± 1.8	3.6 ± 1.5	2.2 ± 1.2
	5.2 ± 1.2	2.9 ± 0.6	2.2 ± 0.7
	p = 0.53	p = 0.57	p = 0.44
With pneumothorax diagnosed on X-ray while inhaling *vs.* without	5.5 ± 1.2	3.5 ± 0.8	2.0 ± 0.6
	5.0 ± 2.0	2.2 ± 0.6	2.8 ± 1.6
	p = 0.67	p = 0.34	p = 0.75
With pneumothorax diagnosed on X-ray while exhaling *vs.* without	6.0 ± 1.3	3.9 ± 0.9	2.0 ± 0.6
	4.4 ± 1.8	1.8 ± 0.6	2.5 ± 1.3
	p = 0.50	p = 0.90	p = 0.34

PO7: postoperative day 7; PO28: postoperative day 28; and CT: computed tomography (scan of the chest).

satory hyperhidrosis and to the remission of the symptoms.[11]

Some patients complain of persistent pain, retrosternal at times, sometimes at the trocar sites and sometimes in the posterior and upper regions of the thoracic wall.[12-15]

The routine of the procedure varies immensely, taking into account the type of tracheal intubation used, the technique for dissection, blockage or excision of the sympathetic chain, postoperative closed pleural drainage or not, among other aspects.[4,9,12,16-28] However, findings in the literature seem to agree on key points: resections of the chain should be as minimal as possible; we should never remove more than one ganglion from the chain; and dissection should begin as caudally as possible, bearing in mind the final objective.[27] In this study, we observed excellent remission rates of palmar and plantar hyperhidrosis, with acceptable rates of compensatory sweating[28] and without any severe or intolerable cases, only by excising completely the third ganglion of the sympathetic chain.

Regarding lung re-expansion after thoracic sympathectomy, be it through lung collapse through a selective tracheal tube or through insufflation of compressed air into the pleural cavity, we tend to believe that, empirically, closed pleural drainage is safer and more efficacious. However, it is known that, even in patients submitted to closed pleural drainage, it is possible to detect small pneumothoraxes.[29] Knowing that the presence of air in the pleural cavity is a potent pain stimulus, and that there is no information on the real incidence of residual pneumothorax after thoracic sympathectomy, with or without closed pleural drainage, assessed by tomography scans,[30] this study was designed to evaluate the possible influence of such residual air on postoperative pain.

In this study, the incidence of residual pneumothorax in the two groups, with and without postoperative pleural drainage, was the same, whether diagnosed on tomography scans or on X-rays (while inhaling or while exhaling).

Through the standardization of the anesthesia session and postoperative analgesia, we overcame the bias in the use of different types of drugs that might have affected postoperative pain. In parallel, with the bilateral internal intercostal blockage of the second to fifth intercostal space,[6] we tried to rule out the influence that intercostal injury and the presence of a pleural drain have on the pain.

Therefore, the presence of residual pneumothorax did not influence the intensity of the pain in any of the periods evaluated, nor did it increase the quantity of opioid analgesics required for take-home analgesia.

Likewise, the presence or absence of the drain did not influence postoperative pain during the periods analyzed. However, the patients who had been submitted to drainage presented a higher incidence of continuous pain when compared to those who had not received drainage, who presented chest pain upon breathing. The intensity of the pain, however, was the same.

It was concluded, in this study, that, in the immediate postoperative period following video-

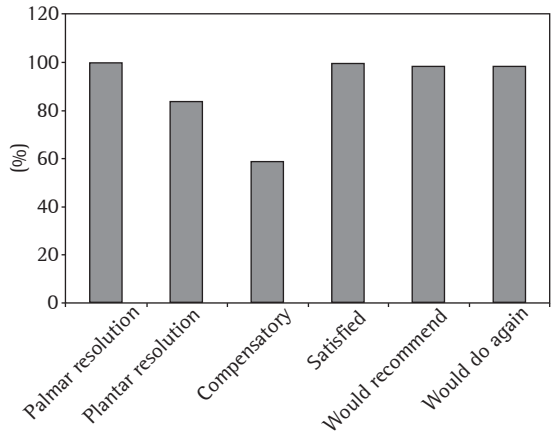

Figure 2 - Results of sympathectomy up to the third thoracic ganglion. Resolution: resolution of hyperhidrosis; Compensatory: compensatory hyperhidrosis; Satisfied: satisfied patients; Would recommend: patients who would recommend the procedure; and Would do again: patients who would undergo the procedure again if necessary.

assisted thoracic sympathectomy, not performing pleural drainage was as efficacious as performing 3 h of closed intercostal drainage in terms of lung re-expansion and the occurrence of residual pneumothorax, as well as that, when residual pneumothorax was present, it did not affect pain within the first 28 postoperative days.

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