

MMCTS

Procedure

Bilateral thoracoscopic sympathetic block by clipping

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▶ Summary

Main cause of dissatisfaction after videothoracoscopic (VATS) sympathectomy in the treatment of hyperhidrosis (HH) and facial blushing (FB) is compensatory sweating (CS). Sympathetic nerve (SN) clipping obtains the same results as sympathectomy in terms of efficacy and safety and levels of CS are similar or lesser than with the standard procedure, with the advantage that if necessary –massive intolerable CS-, this technique theoretically allows to revert the sympathetic block by removing the clips. The surgical procedure is performed through 2 incisions of 10 mm at the mid axillary and anterior axillary lines (3rd and 5th intercostals spaces). Through 2 ports a 30° camera and a diathermy hook are introduced into the pleural cavity. After the identification of the SN, parietal pleura is opened and the chain is isolated. Under videoassistance the SN is clipped at the correspondent level with a right-angled endoscopic clip applier. This surgical procedure is illustrated and an overview of the literature is presented.

Key Words: Hyperhidrosis; Facial blushing; Sympathicotomy; Clipping; Compensatory sweating

▶ 1. Introduction

Hyperhidrosis (HH) and facial blushing (FB) cause severe embarrassment, presenting not only psychological and social problems, but also educational and occupational handicaps. Sympathicotomy has proved to be a good choice of treatment [1].

Compensatory sweating (CS) is the most common complication of sympathicotomy [2], it is developed in about 30–75% of patients and may be troublesome in 5% [3]. The main disadvantage of sympathicotomy in this regard is its irreversibility. To date, no operative method has been successful in resolving this problem.

Clipping of the sympathetic nerve (SN) can treat recurrent HH and FB and also may resolve the possibly bothersome CS. It can be performed safely and efficiently by a trained thoracoscopist and its results and complications are comparable to the sympathicotomy [4].

We used sympathicotomy for the treatment of >300 patients since 1996. However, we changed to clipping in the treatment of HH and FB since 2007.

▶ 2. Surgical technique

The patient is operated under general anesthesia with single lung ventilation (Photo 1) and semi-Fowler position with both arms abducted (Photo 2). A palmar temperature monitoring is routinely used. The instruments needed are two 10 mm trocars, a 10-mm 30° camera, a diathermy hook probe and a right-angled endoscopic clip applier (Acuclip™ Right-Angle Multiple Clip Applier with 20 titanium clips of 8 mm –Covidien-) (Photo 3). Two 10 mm incisions are needed for the trocars, at 3rd and 5th intercostal spaces, at mid axillary line and anterior axillary line (**video 1**). The lung is collapsed by the anaesthesiologist and trocars are introduced after pleurotomy (**video 2**). Through the 2 ports the camera, the hooked diathermy probe, the clip applier and other endo-instruments (if needed) can be used indistinctly (Photo 4; **video 3**). We start at the right hemithorax.

The camera is initially introduced and gently pushed onto the lung apex to gain visibility of the sympathetic chain. Sometimes, meticulous pneumolysis is needed when pleural adhesions are found. The SN is identified and ribs are used as landmarks to locate the desired level to clamp (R2 -2nd rib-, R3 -3rd rib and R4 -4th rib) (**video 4**). Under videoassistance the parietal pleura over the correspondent level of the SN is opened cutting with the hooked diathermy probe (Photo 5; **video 5**). We perform R2 sympathetic block by clipping for FB, R3-R4 for palmar HH and R4-R5 for axillary HH.

In the process of opening the pleura the hook is pushed carefully onto the rib and laterally to the nerve avoiding any neural damage.

Subsequently the hook is used to separate the SN from the rib and sever any pleural attachment in order to create space for the pass of the clip applicator (**Video 6**).

After the nerve trunk is free of pleural attachments the clip applicator is introduced through the upper port. The rib bone under the SN makes difficult the pass of the clip applicator, so this must be done through the upper or lower part of the rib. The clip applicator head is pushed down and advanced laterally until the U shaped mouth of the device comprises the full thickness of the nerve trunk. Then the clip is placed horizontally on the nerve (Photo 6; **video 7**). If Kuntz nerves are present they can be coagulated (**video 8**).

We use a right-angled U-shaped endoscopic multiple clip applicator (Photo 3). Initially, we employed a non-U-shaped applicator, finding it difficult to pass the sympathetic trunk completely with the clip and see its distal part. With the U-shaped applicator –similar to a TEA for bronchus – we have found it much easier and safe to pass the SN and clamp it. We use the rise of palmar temperature and pulse wave changes as indicators of correct SN clipping. The pleura over the correspondent intercostal space is infiltrated under video assistance with 10 ml of levobupivacaine 0.5% for analgesia (**video 9**).

After adequate sympathetic clamping, a single Pleuro-cath drainage is left (Photo 7; **video 10**) and connected to a water-seal device with continuous aspiration, while the same procedure described above is started at the left hemithorax. At this point the anesthesiologist exerts continuous positive pressure for a few seconds to expel the pleural residual air from right hemithorax and to prevent possible incomplete expansion of the lung (**video 11**). If no air leak is present the drainage is removed in the operating room. This is repeated when left SN is clamped. Surgical wounds are closed with intradermic suture for cosmetic considerations. A routine chest radiograph is checked postoperatively to rule out pneumothorax; in this X-ray SN clips are visible (Photo 8). Patients can be discharged 4 hours after the procedure.

In case of massive CS clips can be easily removed. The surgical procedure is the same as described above. Scars of the previous surgery are used for the ports. The camera is pushed onto the lung apex to gain visibility of the SN. Pleural adhesions requiring pneumolysis can be present. The clip to remove is located. A fibrotic layer can cover the clip depending on the time passed from the first surgery (Photo 9), however - independently from the thickness of the layer- the use of the ribs as landmarks makes easy to find the SN and the clip. A curved endograsp instrument is used to remove the clip from the SN. The endograsp tip must grab the “clip tail” (proximal part of the clip). With a gentle lateral movement the clip separates easily from the SN (Photo 10, Photo 11).

▶ 3. Results

Here we present main series of clipping and their results in CS improvement after clip removal.

Table. Main series of clipping for HH and FB.

Serie	Year	Number of patients with clip removal	%	Patients with CS improvement after clip removal (%)
Lin ³ (n=326)	1998	5/326	1,5	80
Lin ⁵ (n=102)	2004	2/102	2	100
Reisfeld ⁶ (n=1274)	2006	31/1.274	2,4	81
Chou ⁷ (n=439)	2006	13/439	2,9	85
Kang ⁸ (n=116)	2008	15/116	13	64
Sugimura ⁹ (n=727)	2009	34/727	4,7	48
Fibla ¹⁰ (n=162)	2011	4/162	2,4	75

4. Discussion

The surgical approach to thoracic sympathectomy has evolved from an open procedure requiring hospitalization to a thoracoscopic approach as an outpatient procedure [11, 12]. The most common thoracoscopic technique is sympathicotomy. It entails identifying the thoracic sympathetic chain and transecting it sharply, with electrocautery or with harmonic scalpel [13].

Despite its efficiency and safety, this procedure has the main disadvantage of being irreversible. The SN conduction is difficult to recover after sympathicotomy and patients might be distressed because of intolerable CS. What is more, some of them may regret the decision of having the surgery performed and might even prefer the original HH or FB.

The treatment options for severe CS after transecting the SN chain are limited. Some investigators suggest using local injection of botulinum toxin in areas where the sweating is more severe [14]. Talaranta 'reconstructed' the SN with sural nerve in five patients with intolerable CS, obtaining good results in four of them. In 1998, he published a case of SN reconstruction with an intercostal nerve graft. In all these cases, he needed a thoracotomy [15]. In an experimental study with pigs, reconstruction of SN was successfully performed with robotic thoracoscopy [16]. Although promising, these cases are exceptional and, by the moment, SN grafting for reversal of sympathectomy cannot be considered a true option to revert sympathetic block.

Although severe CS after transecting SN is estimated to affect only 5% of patients, the lack of a real treatment option makes it a serious problem. The surgeon can only offer to wait for spontaneous recovery or subsidence of CS or experimental techniques, and this gives little hope to the patients.

What cannot be forgotten is that, in addition to transection, the interruption of the thoracic sympathetic chain can also be accomplished by clipping. Clinical experience and multiple studies suggest that these methods are equally effective, and this technique offers a true option of treating severe CS [1].

Denny-Brown and Brenner [17] showed in an animal experiment in 1944 that a compression force of >44 g to nerve fiber for two weeks caused failure of conduction of nerve impulses, with a varying degree of loss of myelin sheaths. Lin et al. started the practice of clipping clamping the T2 sympathetic ganglion in 326 patients with palmar HH obtaining excellent results [3]. Since then multiple groups have adopted this technique.

The major potential advantage of clipping (over, by definition permanent transection) is that, if bothersome CS occurs, clip removal is an option.

Clipping is a minimal procedure with limited dissection, the clip(s) on the thoracic sympathetic chain can be readily identified, accessed, and removed at repeat thoracoscopy [7].

The improvement rate in literature ranges from 50 to 100% [Table]. In our series, 4 patients needed reversible operation and removal of the clip for intolerable CS (2,4%), 3 of them had CS improvement (75%) and 2 (50%) maintained the HH/FB improvement.

Regarding the optimal time for clip removal, the general idea is to do it in the first two months after surgery. Therefore, it is crucial to diagnose intolerable CS as soon as possible. Lin and colleagues suggested that the clip should be removed <2 weeks after clipping, before the degeneration of the SN [3]. In contrast, Reisfeld suggested that the removal within six months might be acceptable for obtaining a successful result [6].

The improvement of the symptoms and the nerve regeneration can take a few months or up to a year. Kang et al. observed improvement of CS four weeks after removal [8], however, Lin et al. saw it one year after [3]. Reisfeld in a series of 25 patients submitted to unclipping because of CS and followed-up during 46 weeks observed maintained improvement in 52% of the cases, and only 28% recovered original HH [18].

Patients expect to be cured from their HH/FB but they fear intolerable CS and like the idea that the procedure might have an option of reversibility.

The effect of clip removal is not 100% effective, and needs to be studied further in larger cohorts; however, the mere fact that the efficacy of clipping and sympathectomy are equivalent, and that reversal is an option only with clipping, should drive thoracic surgeons to this technique.

In conclusion, in our experience SN clipping by VATS has proved to be a safe and effective procedure for the management of FB and palmar/axillary HH. Efficacy and levels of CS are similar than with the standard sympathectomy and, if necessary, this technique allows to revert the sympathetic block removing the clips. Because of these advantages, it is at the present moment our standard procedure for HH/FB treatment.

PHOTOS

Photo 1. Patient is operated under general anaesthesia and intubated with a double lumen tube.



Photo 2. Semi-Fowler position with both arms abducted and axilar regions exposed.



Photo 3. Right-angled endoscopic clip applier (Acuclip™ Right-Angle Multiple Clip Applier with 20 titanium clips of 8 mm –Covidien-)



Photo 4. Through 2 ports the camera, the hooked diathermy probe, the clip applier and other endo-instruments (if needed) are introduced indistinctly. The technique is optimally performed by a surgeon (handling the diathermy hook and clip applier through the upper port) and an assistant guiding the procedure with the 30° camera through the lower port.

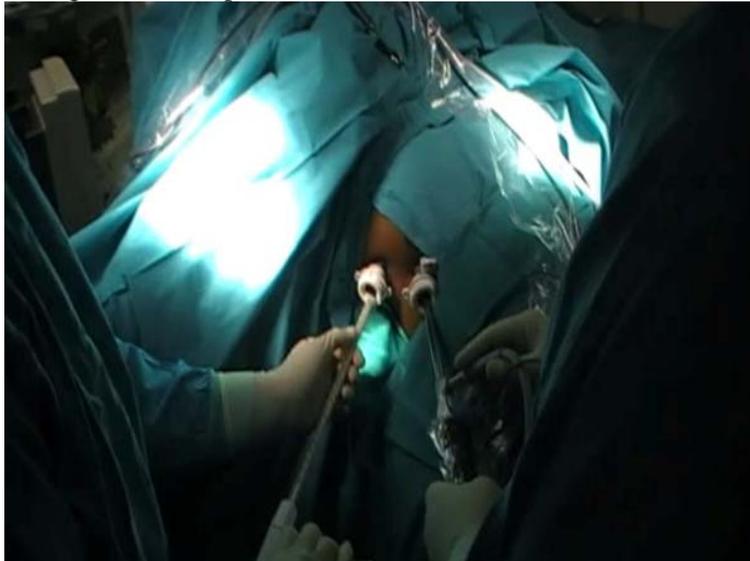


Photo 5. Opening of the pleura over the SN (medially) permits an optimal identification and isolation of the chain.

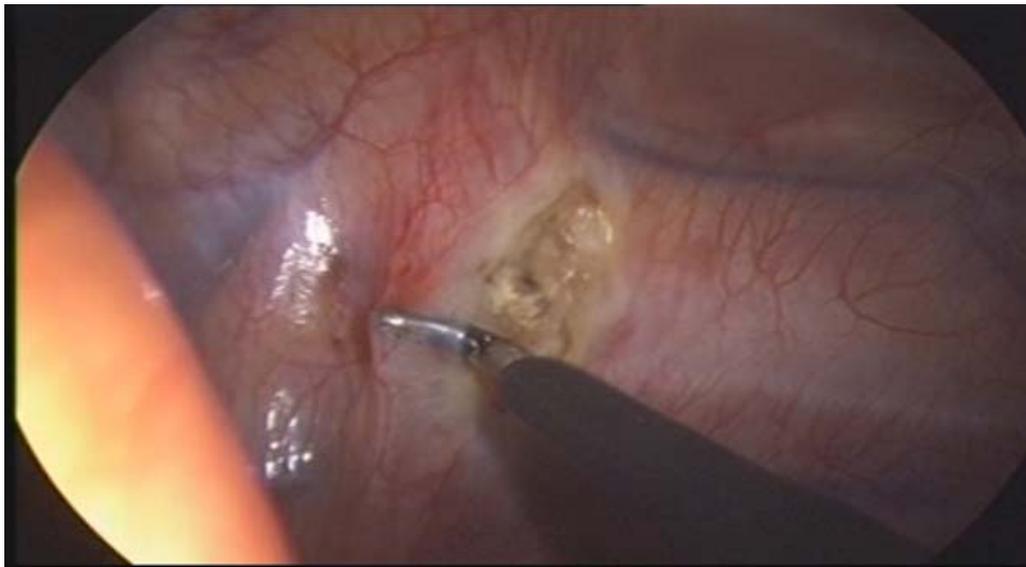


Photo 6. The clip is placed including the full thickness of the SN.



Photo 7. Aspect of the clipped SN. At the end of the procedure a single Pleuro-cath drainage is left and removed in the O.R when the patient is extubated.



Photo 8. Routine postoperative chest-X-ray. The level of clips placement is visible.

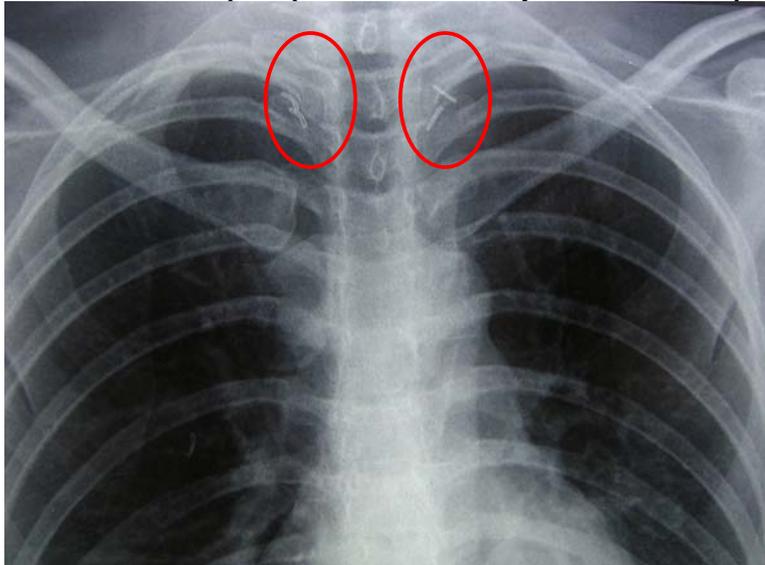


Photo 9. Aspect of the SN clipped (7 months after first surgery).

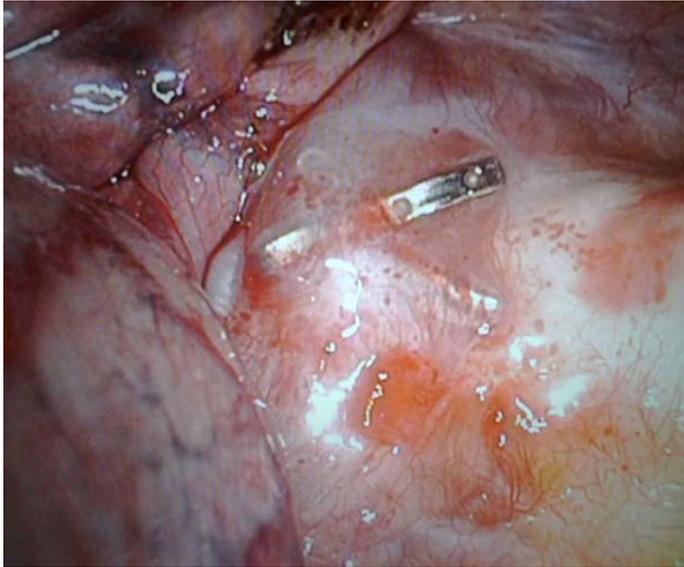


Photo 10. A curved endograsp instrument is used to remove the clip from the SN. The endograsp tip must grab the proximal part of the clip. With a gentle lateral movement (in the sense of the arrow) the clip separates easily from the SN.

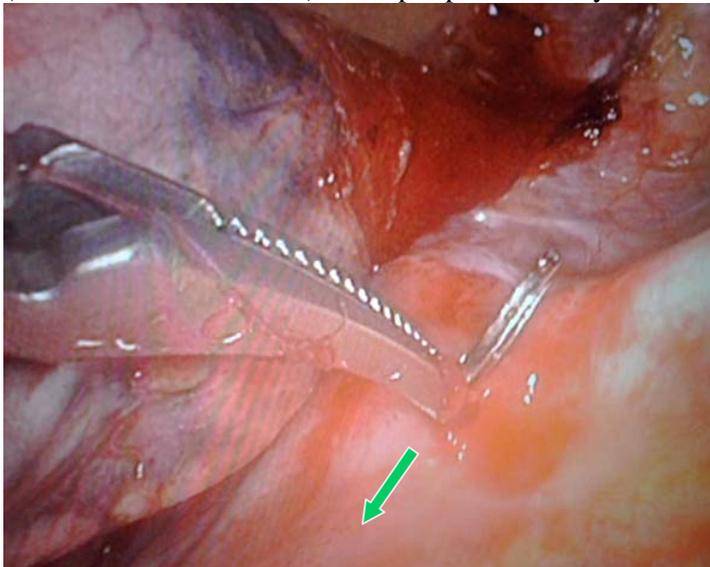


Photo 11. Removed clips.



VIDEOS

- 1) Axilar region with drawn incision lines for the trocars.
- 2) Pleurotomy and trocar insertion process.
- 3) Introduction of the hook probe under camera control.
- 4) Rib counting and SN palpation.
- 5) Opening the pleura with the hook probe.
- 6) The hook passes below the SN to create space for the clip applier.
- 7) Placement of 2 clips in the SN.
- 8) Kuntz nerves coagulation.
- 9) Intercostal nerve infiltration with local anaesthetic.
- 10) Pleuro-cath drainage placement.
- 11) Lung reexpansion.

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