Eur J Cardio-thorac Surg (1996) 10:168–172


ORIGINAL ARTICLE

E. N. Yilmaz
A. H. M. Dur
M. A. Cuesta
J. A. Rauwerda

# Endoscopic versus transaxillary thoracic sympathectomy for primary axillary and palmar hyperhidrosis and/or facial blushing: 5-year-experience

Received: 5 July 1994
Accepted: 5 May 1995

E. N. Yılmaz · A. H. M. Dur ·
M. A. Cuesta · J. A. Rauwerda (✉)
Department of Vascular Surgery,
Free University Hospital, P.O. Box 7057,
1007 MB Amsterdam, The Netherlands

**Abstract** Thoracic sympathectomy is effective in the permanent cure of primary axillary and palmar hyperhidrosis and facial blushing, which can be so troublesome for patients that their social and professional relations can be affected. Between October 1988 and April 1994, a total of 50 thoracic sympathectomies (10 surgical and 40 endoscopic) were performed on 5 and 23 patients, respectively. The operations were performed unilaterally, followed by the contralateral intervention after a period of 6–8 weeks. The thoracic ganglia T2–T5 were resected for hyperhidrosis. If the patient suffered from blushing, the lower 1/3 of the stellate ganglion was also resected. Postoperatively, all the operated limbs were warm and dry. In the group of patients who were operated bilaterally, only one had persistent facial blushing. The efficacy for blushing in this series was therefore 93.3%. The late relapse rate of sympathetic activity was 14.3%. Compensatory sweating was seen in 67%, gustatory sweating in 37.5% and phantom sweating in 29% of the patients. None of them considered these side effects to be troublesome. Although there is no difference between transaxillary thoracic sympathectomy and the endoscopic intervention in terms of efficacy, the latter is associated with less postoperative pain, shorter hospital stay and a rapid recovery. The thoracic sympathectomy is the treatment of choice for primary hyperhidrosis and excessive facial blushing.
[Eur J Cardio-thorac Surg (1996) 10:168–172]

**Key words** Hyperhidrosis · Blushing · Sympathectomy ·

Endoscopic thoracic sympathectomy is a procedure which has rapidly gained popularity in the last decade. It is especially effective in the permanent cure of primary axillary and palmar hyperhidrosis and facial blushing. Facial blushing itself is a normal reaction which does not require any therapy. The mechanism of blushing is still unknown. The reason why some people blush extraordinarily have been explained by hypersensitivity of their cardiovascular system in reacting to emotional stimuli. Another theory is increased filling of the superficial venous plexus and/or arteriolar dilatation caused by a cerebral inhibition of the vasoconstrictor tone [17]. This physiological response can be so troublesome for patients that their social and professional relations can be effected. Essential hyperhidrosis, excessive sweating of the body parts, mostly of axillae and palms of the hands is an unpleasant condition of unknown origin with a prevalence of 0.6–1% [3]. It is mainly a problem of young people in the second or third decade of life, usually starting in puberty. Just like facial blushing, this entity also has an impact on social and professional life and may lead to emotional problems (i.e. wetness of clothes, difficulty in shaking hands, in writing, etc).

Facial blushing and hyperhidrosis are relatively subjective problems. Treatment is almost always determined by the degree to which a patient suffers. Due to the common course of vasomotor and sudomotor fibers, hyperhidrosis is accompanied by blushing in 50% of the cases. Concomitant ipsilateral facial blushing is largely eliminated – and

often diminshed contralaterally – by thoracic sympathectomy. In our referral center, thoracic sympathectomy has been performed for facial blushing and hyperhidrosis in the last decade. The purpose of this study is to present our results during the last 5 years.

## Patients and methods

Between October 1988 and April 1994, a total of 50 thoracic sympathectomies (10 surgical and 40 endoscopic) were performed on 5 and 23 patients, respectively. The data are given in Table 1.

All the patients were evaluated by the Department of Endocrinology. A chest X-ray was performed to exclude apical pleural disease which may suggest the presence of adhesions. The operations were performed unilaterally, followed by the contralateral intervention after a period of 6–8 weeks. The surgical sympathectomies were performed via the transaxillary approach. Operations were performed surgically from October 1988 to April 1991 and afterwards thoracoscopically. We used the transaxillary approach for open thoracic sympathectomy, because of good exposure of the anatomy and better cosmetic results.

For thoracoscopic sympathectomy, the patient is anesthesized using a double-lumen endotracheal tube and placed on the operating table in the lateral decubitis position with fixation of the upper arm, which is abducted to 90°. Three trocars are introduced over the third intercostal space, on the posterior, the mid-axillary and the anterior axillary lines. The first two are used for instrumentation, and the third for the thoracoscope. The lung is slowly deflated using a Verres's needle, by introducing 0.5–1.0 l carbondioxide ($CO_2$) into the intrapleural space, with a maximum pressure of 4 mmHg. The Verres's needle is then removed and the thoracoscope inserted After identification of the sympathetic chain, the thoracic ganglia T2–T5 and their interconnecting fibers are resected for hyperhidrosis. If the patient suffers from blushing, the lower 1/3 of stellate ganglion is also resected. A 12 Charrière drain is placed thorugh the incision on the posterior axillary line, under direct camera vision before the lung is reinflated.

All specimens were histologically examined. A postoperative chest X-ray was routinely performed after removal of the drain. Most of the patients left hospital the day after the endoscopic operation. They were interviewed to assess their satisfaction with the technique. Responses concerning efficacy of the procedure were graded as excellent, good, some improvement or no change in relation to each patient's preoperative state for each limb being treated. The cosmetic outcome was graded as excellent, satisfactory or poor. Responses concerning the efficacy were either excellent or good in all patients, except for one with blushing. Responses for cosmetic outcome were either excellent or satisfactory, as well. We therefore considered the outcome to be either satisfactory or not.

**Table 1** Patient data

| | Surgical sympathectomies | Thoracoscopic sympathectomies |
|---|---|---|
| Total no of operations | 10 | 40 |
| Bilateral | 5 | 17 |
| Unilateral | 0 | 6 |
| Total no. of patients | 5 | 23 |
| M/F | 2/3 | 9/14 |
| Age range (years) | 22–43 | 15–48 |
| Average age (years) | 32.6 | 30.9 |
| Follow-up (months) | 43–60 | 0–30 |
| Average follow-up (months) | 52.2 | 11.2 |
| Operation indication | | |
| Blushing | 0 | 4 |
| Hyperhidrosis | 1 | 7 |
| Both | 4 | 12 |
| Complications | | |
| Horner's syndrome (unilat. transient) | 1 | 1 |
| Neuralgia | 1 | 4 |
| Pneumothorax | 0 | 1 |
| Winged scapula (transient) | 4 | 0 |

## Results

*Immediate results:* Postoperatively, all the operated limbs were warm and dry.

*Complications:* The complications are listed in Table 1. We had no perioperative mortality.

*Efficacy:* The long-term data are given in Table 2. Of the 15 patients who were operated bilaterally due to blushing with or without hyperhidrosis, only one had facial blushing, postoperatively. So, the efficacy for blushing in this series is 93.3%. The patients with blushing, who have only been operated unilaterally so far are not included in the evaluation. A total of 24 patients were operated due to hyperhidrosis of the palms and/or axillae with or without blushing. All were satisfied with the results. From this group, three patients noticed the return of moderate sweating 10 months after the operation. None of them considered this so troublesome as the situation before the operation. The late relapse rate of sympathetic activity is 14.3%.

*Cosmetic aspect:* Both groups of patients considered the operation scars acceptable, as they were hardly visible.

**Table 2** Indication and method of sympathectomy according to available long-term data

| | Endoscopic sympathectomies | Surgical sympathectomies | Total |
|---|---|---|---|
| No. of patients with available long-term data | 19 | 5 | 24 |
| Patients with hyperhidrosis[a] | 16 | 5 | 21 |
| Patients with blushing[b] | 11 | 4 | 15 |

[a] Patients with hyperhidrosis with or without blushing
[b] Patients with blushing with or without hyperhidrosis, bilaterally operated

*Side effects:* Compensatory sweating was seen in 67% (16/24) of the patients. Gustatory sweating was experienced by 37.5% (9/24) of the patients. Phantom sweating was also recorded in 29% (7/24). None of them considered these side effects to be troublesome.

## Discussion

Thoracic sympathectomy is effective as a permanent cure of primary axillary and palmar hyperhidrosis and facial blushing. Although it can be used for treatment of vasospastic conditions of the fingers, it has proven to be less effective for these conditions, which usually depend on the progression of the underlying disease [17, 24]. Other indications for thoracic sympathectomy are sympathetic dystrophy, blue finger syndrome and cardiac disease [2, 6, 14, 24, 47]. Thoracic sympathectomy for cardiac problems such as angina pectoris, tachycardia etc. is experimental and there have been no reports of endoscopic procedures for these indications yet [36, 58].

In the literature, a less commonly described indication for thoracic sympathectomy is excessive facial blushing. Blushing and sweating are generally considered to be related to vasomotor and sudomotor innervation. The preganglionic neurons related to the vasomotor and sudomotor activity of the face originate in the spinal cord segments C8–L2 and the post-ganglionic fibers ascend mainly in the cervical sympathetic trunk and reach their organs via different routes. The exact physiopathological mechanism of blushing is unknown. Blushing and hyperhidrosis together are seen in almost half of the cases, probably due to a common course of vasomotor and sudomotor fibers.

There are various etiological factors which may lead to hyperhidrosis. For this reason, preoperative endocrinological and neurological screening of all patients is necessary to rule out neurological and endocrinological disorders such as ischemic, hemorrhagic or traumatic lesions of the central or peripheral nervous system, pheochromocytoma, hormone-producing malignancies, hyperthyroidism, diabetes mellitus and congenital neurodermal malformations [5, 8, 18, 20, 25, 29, 31, 39–41, 44, 45, 50, 51, 54, 56]. Hamartoma of the eccrine glands can cause unilateral hyperhidrosis [30, 49]. Many different therapies have been used. Being triggered by emotional stimuli, this condition is treated with sedatives, sympatholytic and anticholinergic agents [55, 56]. However, pharmacotherapy seems to be of limited value, due to intolerable side effects. For hyperhidrosis, topical application of various chemicals has been advocated with little success [33, 37, 46]. Excision of axillary sweat glands is sometimes performed [16]. Behavioral therapy and psychotherapy can also have limited success [17].

Different methods of thoracic sympathectomy, such as open surgical intervention, thermocoagulation, $CO_2$ laser irradiation and chemical ablation with alcohol injection have been under investigation for several decades, with various rates of success. Although originally encouraging, chemical sympathectomy with ultrasound or computed tomography (CT) guidance has lately been abandoned due to long-term relapses [1, 4, 13, 60]. The percutaneous destruction of the thoracic sympathetic ganglia by either radiofrequency or thermocoagulation, and endoscopic fiberoptic laser irradiation have shown convincing short-term results, but these methods need to be further investigated in the long term [7, 11, 27, 28, 59]. Surgical thoracic sympathectomy for hyperhidrosis has been widely accepted due to its immediate as well as in long-term effectiveness. However, limited patient satisfaction due to postoperative pain, scar formation, risk of damage to large vessels and nerves, and morbidity up to 20% with a wide spectrum of complications following axillary thoracic sympathectomy have led to the search for a less invasive method [21, 23, 26, 42, 43].

In our experience, the excision of the lower 1/3 of the stellate ganglion and thoracic sympathetic ganglia from T2 to T5 seem to be sufficient to achieve a satisfactory result. Although it increases the risk of Horner's syndrome, excision of the lower 1/3 of the stellate ganglion is essential to cure blushing [23]. The extent of ganglion excision has always been a subject for discussion. The determination of the optimal degree of sympathetic denervation is difficult because of the anatomic variability of the sympathetic chain [48]. Some authors perform extensive denervation from T1 to T6, whereas others find ablation of only T2 sufficient [32, 34, 35, 53]. From the anatomical point of view, Drott [14] proposes ganglionectomy of T2 and T3 for the sympathetic denervation of the hand and adds T4 for the axillary region. Most authors actually agree about excision of the thoracic ganglia from T2 to T4 for optimal sympathetic denervation of the upper limb. The immediate success rate of thoracic sympathectomy in hyperhidrosis varies from 92% to 100% [2, 6, 14, 15, 21, 23, 43, 47]. The reasons for failure and recurrence in the early phase are partial coagulation or excision of the sympathetic chain. We prefer excision to coagulation.

There is controversy about the long-term efficacy of thoracic sympathectomy. Although some authors claim that relapse after a successful sympathectomy is unlikely [22], others have documented the probability of late recurrences due to sensitization (supersensitivity) produced by section of postganglionic fibers [9, 12, 19]. In spite of the successful immediate results, Hashmonai et al. observed recurrence of hyperhidrosis within 2–18 months after the operation in 6.5% of the patients [23]. There is no further indication for resympathectomy from such a relapse. In our series, 3 of 21 patients operated for hyperhidrosis had some degree of sweating start approximately 10 months after surgery. The rate of late recurrence in our series for hyperhidrosis was 14.3% after an average follow-up of 32 months.

Thoracic sympathectomy is associated with interesting side effects. The most common one is compensatory sweat-

ing (excessive sweating in the lower half of the body), which is probably a thermoregulatory response [52]. In our group of patients, 67% of the patients seemed to experience this. All accepted this as a relatively minor problem, compared to the original one. In the literature, the incidence of compensatory hyperhidrosis varies from 10 to 75% [2, 7, 14, 19]. Gustatory sweating (increased sweating of the face while eating, especially triggered by spicy food) has also been reported in from 8 to 48% of the cases by various authors [2, 14, 15, 23], which was in concordance with our findings (37.5%). This symptom was not very disturbing for the patients. Phantom sweating (perception of sweating despite its absence) is thought to be of cerebral origin and the exact mechanism is not clear. It has been observed in 10–48% of patients [14] and 29% in our group of patients.

To our surprise, except for one patient with compensatory and another one with gustatory sweating, the patients were not aware of the side effects until our questionnaire. They admitted to having the side effects after detailed description of these. None of them found the side effects troublesome in their social lives, especially compared to the original problem.

Complications after endoscopic interventions are limited. These are permanent or transient Horner's syndrome, pneumothorax (rarely requiring drainage), bleeding leading to hematothorax and areas of numbness and neuralgia due to damage to intercostal nerves [9, 15, 35]. Most of these complications are self-limited, having no permanent clinical impact at all. Although we have chosen unilateral intervention followed by the contralateral side in 6–8 weeks time, due to possible serious complications after a bilateral thoracotomy or a thoracoscopy, some other authors have had good results with bilateral interventions in the same session [10, 13, 15, 38, 57].

After thoracoscopic sympathectomies, most patients leave the hospital after an overnight stay. Most of them start working as quickly as 1 week after the operation. Following the transaxillary thoracic sympathectomies, the average hospital stay was 5.9 days, and most of the patients could start working after 6–8 weeks. Postoperative analgesics were necessary for less than 1 week after the endoscopic intervention, whereas the patients who had undergone open surgery had to continue with analgesics for at least 3 weeks. No pulmonary problems were encountered in either group. In conclusion, therefore, thoracic sympathectomy is a well-tolerated procedure, which is cosmetically convenient, safe and efficient. Although there is no difference between transaxillary thoracic sympathectomy and the endoscopic intervention in terms of efficacy, the latter is associated with less postoperative pain, shorter hospital stay and a rapid recovery. The endoscopic thoracic sympathectomy is the treatment of choice for primary hyperhidrosis and excessive facial blushing.

## References


1 Aarts HF (1980) Regional intravascular sympathetic block with guanethidine, Academisch Proefschrift, Amsterdam

2. Adams DCR, Wood SJ, Tulloh BR et al. (1992) Endoscopic thoracic sympathectomy: experience in the South of West England Eur J Vasc Surg 6 558–562

3 Adar R, Kurchin A, Zweig A et al. (1977) Palmar hyperhidrosis and its surgical treatment: A report of 100 cases. Ann Surg Vol 186·34–41

4. Adler OB, Engel A, Rosenberger A et al. (1990) Palmar hyperhidrosis CT guided chemical percutaneous thoracic sympathectomy. Fortschr Rontgenstr 153:400–403

5. Andersen LS, Biering-Sorensen F, Muller PG et al. (1992) The prevalence of hyperhidrosis in patients with spinal cord injuries and an evaluation of the effect of dextropoxyphene hydrochloride in therapy Paraplegia 30(3):184–191

6. Appleby TC, Edwards WH (1992) Thoracoscopic dorsal sympathectomy for hyperhidrosis: A new approach. J Vasc Surg 16:121–123

7. Austin JJ, Doobay B, Schatz SW (1992) Transaxillary endoscopic laser sympathectomy. Can J Surg 35(4):414–416

8. Beylot M, Taieb A, Surleve JE et al. (1992) Inflammatory familial palmoplantar keratoderma: Greither's Disease? Dermatology 185(3)·163–165

9. Bogokowsky H, Slutzki S, Bacalu L (1983) Surgical treatment of primary hyperhidrosis. Arch Surg 118 1065–1067

10. Bryne J, Walsh TN, Hederman WP et al. (1990) Endoscopic transthoracic electrocautery of the sympathetic chain for palmar and axillary hyperhidrosis. Br J Surg 77:1046–1049

11. Chuang KS, Liou NH, Liu JC (1988) New stereotactic technique for percutaneous thermocoagulation of upper thoracic ganglionectomy in cases of palmar hidrosis. Neurosurgery 22:600–604

12. Cloward RB (1969) Hyperhidrosis J Neurosurg 30:545–551

13. Dondelinger RF, Kurdziel JC (1987) Percutaneous block of the upper thoracic chain with CT guidance. A new technique. Acta Radiol 28:511–515

14. Drott C, Gothberg G, Claes G (1993) Endoscopic procedures of the upper-thoracic sympathetic chain. A review. Arch Surg 128:237–241

15. Edmondson RA, Banerjee AK, Rennie J et al. (1992) Endoscopic thoracic sympathectomy in the treatment of hyperhidrosis. Ann Surg 215(3):289–293

16. Endo T, Nakayama Y (1993) Surgical treatment of axillary hyperhidrosis. Ann Plast Surg 30(2) 136–139

17. Geldermann PW, Baljet B, Groen GJ, Meer C van der, Lemmens HAJ, Drukker J, Wittmoser R, Siemens H, Swinkels JA (1985) Symposium on pathological blushing and sweating. Acta Neurochir 74 148–157

18. Gonzales L, Sanchez T, Lopez FR et al. (1992) Pheochromocytoma: a motley tumor (abstract). Ann Med Interne 9(9):447–449

19. Gouleke PJ, Garrett WV, Talkington CM (1988) Dorsal sympathectomy for hyperhıdrosıs: the posterior paravertebral approach Surgery 103:568–572
20. Grımm JJ, Jequier E, Reglı F (1981) Alteratıon de fonctions vegetatives dans la neuropathıe diabetique reflex cardiovasculaires et sudation. Schweiz Med Wochenschr 111:669–675
21. Gyftokostas D, Koutsoumbelis C, Daskalakıs E et al. (1992) Telford's operatıon for palmar hyperhidrosıs. Angiology 43 (4): 336–341
22 Hartfall WG, Johimsen PR (1972) Hyperhıdrosıs of the upper extremity and ıts treatment. Surg Gynecol Obstet 135:586–588
23. Hashmonaı M, Kopelman D, Schein M (1992) Upper thoracic sympathectomy for prımary palmar hyperhidrosıs: long-term follow-up. J Surg 79:268–271
24. Hederman WP (1993) Endoscopıc sympathectomy. Br J Surg 80·687–688
25. Heimer WL, Brauner G, James WD (1992) Dermatopathıa pigmentosa reticularis· a report of a famıly demonstratıng autosomal dominant ınherıtance. J Am Acad Dermatol 26(2 Pt 2):298–301
26. Julıus AJ, Van Mourık JC (1985) Transaxillaire thoracale sympathectomıe ter behandlung van primaire hyperhidrosıs en rubeosis Ned Tijdschr Geneeskd 129:1042–1045
27. Kao MC (1992) Vıdeo endoscopıc sympathectomy usıng a fiberoptic $CO_2$ laser to treat palmar hyperhidrosis. Neurosurgery 30(1)·131–135
28. Kao MC (1992) Laser endoscopıc sympathectomy for palmar hyperhidrosıs. Lasers Surg Med 12:308–312
29. Konagaya Y, Konagaya M, Nakamuro T (1993) Recurrent polyradiculoneuropathy with hyperthyroıdism. Eur Neurol 33(3) 238–240
30. Kopera D, Soyer HP (1992) Ekkrines Hamartom der Schweißdrüsen unter dem Bild einer lokalısıerten unılateralen Hyperhidrose. Hautarzt 43(9):587–589
31. Korpelainen JT, Sotaniemı KA, Myllyla VV (1992) Hyperhidrosis as a reflectıon of autonomıc faılure in patıents with acute hemıspheral brain infarction. Stroke 23(9):1271–1275
32. Kux M (1978) Thoracic endoscopic sympathectomy ın palmar and axillary hyperhidrosis Arch Surg 113:264–266
33 Langendijk PN, Zuurmond WW, Van Apeldoorn HA et al. (1993) Goede resultaten van behandeling van acute reflectoıre sympathetische dystrofie met een 50% dimenthylsulfoxıde creme. Ned Tıjdschr Geneeskd 137(10):500–503
34 Lin CC (1990) A new method of thoracoscopıc sympathectomy ın hyperhidrosis palmaris. Surg Endosc 4.224–226
35. Lın CC (1992) Extended thoracoscopıc T2 sympathectomy ın treatment of hyperhıdrosis: Experıence with 130 consecutıve cases. J Laparoendosc Surg 2:1–6
36. Lındgren I (1950) Angına pectorıs. a clinical study with specıal reference to neurosurgical treatment. Acta Med Scand Suppl 243:1–203
37. Lycka BA, EMLA (1992) A new and effective topical anesthetic. J Dermatol Surg Oncol 18(10):859–862
38. Malone PS, Duıgnan JP, Hederman WP et al. (1982) Transthoracic electrocoagulatıon: a new approach to upper limb sympathectomy. Ir Med J 75:20–21
39. Manetto V, Medorı R, Cortellı P et al. (1992) Fatal famılial ınsomnıa: clınical and pathologic study of five cases. Neurology 42(2):312–319
40. Mc Coy BP (1982) Apıcal pulmonary adenocarcinoma with contralateral hyperhidrosis. Arch Dermatol 117:659–661
41. Mon Y, Mızotani M (1992) A case of hemi-hyperhıdrosıs and non-paralytic pontine exotropia due to brain stem infarctıon (abstract). Rınsho Shınkeigaku 32(7):718–721
42. Moran K, Brady MP (1991) Surgıcal management of primary hyperhıdrosıs. Br J Surg 78:279–283
43. O'Riordain D, Maher M, Waldron D et al. (1993) Lımiting the anatomıc extent of upper thoracıc sympathectomy for primary palmar hyperhıdrosis. Surg Gynecol Obstet 176 151–154
44. Ottomo M, Heimburger F (1980) Alternating Horner's snydrome and hyperhidrosis due to dural adhesions followıng cervical spinal cord injury: a case report J Neurosurg 53:97–100
45. Posteraro AF (1992) Papillon-Lefevre Syndrome. J Ala Dent Assoc 76(3):16–9
46. Reinauer S, Schauff G, Holzle E (1993) Ross syndrome treatment of segmental compensatory hyperhidrosıs by a modifıed ıontophoretic device. J Am Acad Dermatol 28 (2 Pt 2): 308–312
47. Robertson DP, Sımpson RK, Rose JE et al. (1993) Video-assisted endoscopıc thoracic ganglıonectomy. J Neurosurg 79 238–240
48. Roos DB (1977) Sympathectomy for the upper extremities: anatomy, indications and techniques in vascular surgery. In: D Rutherford (ed) Vascular Surgery. Saunders, Philadelphia, p 460
49. Ruiz F, Vazquez FJ, Contreras F et al. (1992) Localized unılateral hyperhidrosis: eccrine nevus. J Am Acad Dermatol 27(1) 115–116
50. Sakashita Y, Kakuta K, Kakuma K et al. (1992) Unılateral persistent hyperhıdrosis after ischemıc stroke (abstract). Rinsho Shinkeigaku 32(4) 454–456
51 Sawada H. Serıu N, Udaka F et al (1992) Autonomıc dysfunction of central nervous system disorders (abstract). Nıppon Rinsho 50(4):799–805
52. Shıh CJ, Lin MT (1979) Thermoregulatory sweating in palmar hyperhidrosis before and after upper thoracıc sympathectomy. J Neurosurg 50:88–94
53. Sternberg A, Brıckman S, Kott I et al. (1982) Transaxıllary thoracic sympathectomy for prımary hyperhidrosıs of the upper limbs. World J Surg 6:458–463
54. Sudou K, Tashiro K (1993) Segmentalhyperhidrosıs in syringomyelia wıth Chıari malformatıon J Neurol 240(2):75–78
55. Takase Y, Tsushimi K, Fukusako T (1992) Unilateral localized hyperhıdrosis responding to treatment wıth clonazepam (letter). Br J Dermatol 126(4):416
56. Walker BR, Anderson JA, Edwards CR (1992) Clonıdine therapy for Shapiro's syndrome. Q-J-Med 82(299):235–245
57. Weale FE (1980) Upper thoracic sympathectomy by transthoracic electrocoagulation. Br J Surg 67:71–72
58. White JC, White PD (1928) Angina pectorıs: treatment with alcohol ınjectıons. JAMA 90:1099–1103
59. Wilkınson HA (1984) Percutaneous radıofrequency upper thoracic sympathectomy: a new technique. Neurosurgery 15:811–814
60 Yamauchı Y, Kojoh H, Nagaro T et al. (1993) Treatment of hyperhidrosıs with caudal epidural block in a patient wıth cervıcal cord ınjury (abstract). Masui 42(4):606–610