Pediatr Surg Int (2012) 28:245–248
DOI 10.1007/s00383-011-2984-3

ORIGINAL ARTICLE

Thoracoscopic excision of the sympathetic chain: an easy and effective treatment for hyperhidrosis in children

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Accepted: 6 September 2011 / Published online: 30 September 2011

Abstract
Background Thoracoscopic sympathectomy (TS) is an effective treatment for hyperhidrosis. Various surgical approaches are described in the literature. We describe the technique of thoracoscopic excision of the sympathetic chain done exclusively in children younger than 13 years.
Methods All patients younger than 13 years who underwent TS from 2006 at a single institution were prospectively identified and fully evaluated with emphasis on demographic data, age, surgical management, complications and follow-up. All patients were contacted again at the end of 2009 to complete a follow-up questionnaire.
Results Twelve patients underwent TS between 2006 and 2009. Age ranged from 6 to 13 years. This involved T2–T3 excision for nine patients with isolated palmar hyperhidrosis, and T2–T3–T4 excision for three with additional axillary hyperhidrosis. Six underwent bilateral TS at the same session and six underwent unilateral TS for the dominant side. Four of them had their contralateral operation performed 2–3 months later. Dry limbs were immediately achieved in all patients. Compensatory sweating (CS) was noted in eight patients. Complications included transient ptosis in two and mild recurrence in one.
Conclusions Thoracoscopic excision of the sympathetic chain is a simple and safe procedure that relieves hyperhidrosis in all cases and significantly improves the quality of life.

Keywords Thoracoscopic sympathectomy · Sympathectomy · Children · Sympathetic chain · Hyperhidrosis

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Introduction

Palmar hyperhidrosis (PH) in children can be debilitating to their social life and school development. Conservative measures are usually ineffective in severe cases. Thoracoscopic sympathectomy (TS) as an effective treatment for upper limb hyperhidrosis has been described in different ways including; diathermy ablation [1], chemical ablation [2], ultrasonic coagulation [3] and transection of the sympathetic chain [4] with varying degrees of success. Most large series involve adolescents or adult population [5, 6] with less reported experience in children below 13 years of age. We report a different technique for performing TS in children younger than 13 years, which involves thoracoscopic excision of the sympathetic chain.

Materials and methods

All patients younger than 13 years who underwent TS from 2006 at a single institution were prospectively identified and fully evaluated with emphasis on demographic data, age at presentation, surgical management, complications and follow-up. All patients and their parents were contacted again at the end of 2009 to complete a detailed telephone follow-up questionnaire, to identify the success rate, side effects of the procedure, satisfaction degree, particularly the development of compensatory sweating (CS) and its effect on the quality of their lives.

Operative technique

All cases were intubated using a regular oro-tracheal cuffed single-lumen tube with double-lung ventilation. No

single-lung ventilation was needed. Patients were positioned supine with the arms abducted and a roll placed behind the shoulders. The first port (5 mm port for the camera) was inserted using the open technique in all patients in the fifth space mid-clavicular line (just inferior to the nipple). Two working instruments were then introduced without ports under direct vision, using the stab technique at a higher level (Fig. 1). Local anaesthetic was infiltrated to port sites to decrease post-operative pain. To improve access to the upper sympathetic chain, the head was elevated to encourage inferior displacement of the upper lung lobe. The pneumothorax was maintained by the use of low-flow (1 L/min) and low-pressure (4 mmHg) CO_2 infusion during the procedure, which was gradually increased to 6 mmHg if needed.

Normal anatomy was delineated by counting from the second rib downwards to identify the desired level of dissection. In isolated palmar hyperhidrosis (PH), T2–T3 were excised and in associated axillary hyperhidrosis (AH), T4 was added to the resection. The parietal pleura was opened over T4 or T5 and spread wide open, to carefully identify any aberrant nerves. The sympathetic chain was coagulated and separated beginning caudally and proceeding cranially, coagulating any lateral communications. The sympathetic chain was finally divided at T2 using diathermy scissors, taking care not to injure the stellate ganglion.

At the end of the procedure, CO_2 was evacuated, and the collapsed lung was allowed to re-expand under vision. Ports and instruments were removed under vision. Pleural drainage was not required in any patient. Finally, the resected specimen was sent for the histopathological assessment.

The same operative technique was used in all the patients under supervision of the senior author by a total of three experienced paediatric surgeons.

Results

Twelve patients (8 females and 4 males) underwent TS for the upper limb hyperhidrosis between 2006 and 2009. Age ranged from 6 to 13 years (mean age 10.1 years). Nine patients had isolated PH requiring T2–T3 excision and three patients had combined palmar and axillary hyperhidrosis requiring T2–T3–T4 excision. All patients had associated plantar hyperhidrosis and one patient had excessive sweating affecting all over the body with associated significant palmar skin excoriations.

Six patients underwent bilateral TS at the same session and six patients underwent unilateral TS for the dominant arm. Four of them had their contra-lateral operation done 2–3 months later (Fig. 2). One patient had an aberrant nerve detected on the left side, which was identified, coagulated and divided. Mean operative time was 25 min for unilateral and 40 min for bilateral TS. All patients were discharged home the following day.

Ten patients were followed up for 1–3 years. Two patients were lost to follow-up 1 month post-operatively. Dry limbs were immediately achieved in all patients. Transient ptosis occurred in two patients, one improved after 1 month and the other after 6 months. Minor recurrence of the symptoms occurred in one patient after 1 year, which was not distressing or interfering with the quality of her life and no further intervention was needed. Compensatory sweating (CS) was noted in eight patients (66.7%),

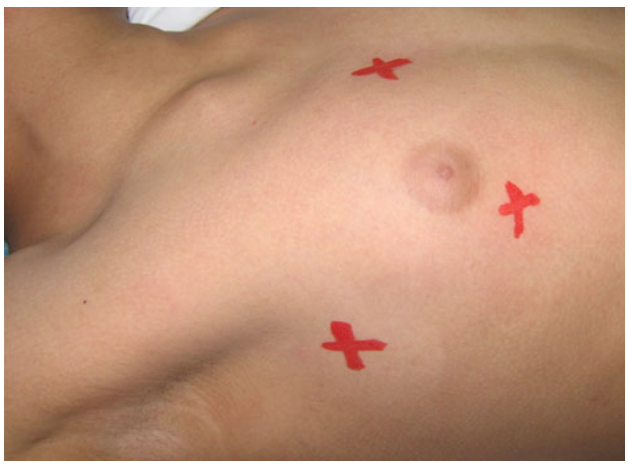

Fig. 1 Port sites for thoracoscopic excision of the sympathetic chain: camera placed in the fifth space mid-clavicular line just under the nipple, and the two working instruments at a higher level

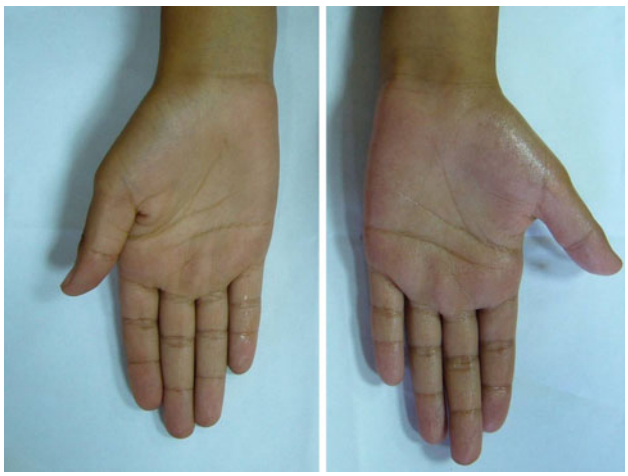

Fig. 2 Post-operative results after unilateral TS: completely dry right hand is evident in comparison to the wet left hand. Patient was very satisfied after her right-sided TS and proceeded to left-sided TS

although none of them reported this as a complication. All patients and their parents were satisfied and reported a significant improvement in the quality of their lives.

Discussion

Severe PH is a significant social and emotional problem in children. Its occurrence in children has been probably under-recognized with a recent study reporting that up to 1.6% of children and adolescents younger than 18 years had primary focal hyperhidrosis [7]. Most reported series concentrate on procedures performed in the adolescent or adult age group with a mean age in the 20s [5, 6]. Lin and Fang [6] describe a mean age of surgery of 23 years in 1,360 patients, despite 81.5% reporting symptoms since childhood, 15.9% since adolescence, and only 2.6% since adulthood. Even in reports describing TS in children, the median age was 15.4 years [8]. Although our series is smaller, we include only children below 13 years of age.

TS is classically reserved for severe cases only after failed conservative measures [9], although it was recommended recently as the first-line treatment for the severe forms of PH [10]. All the children in our presented series had severe PH that was significantly interfering with their social life and school development. In view of the excellent post-operative satisfaction, we advocate early surgery for children with debilitating symptoms of PH, and would endorse this procedure to other paediatric surgeons to limit the impact of this condition on sufferers.

Different authors described the technique for TS in various ways including diathermy ablation [1], chemical ablation [2], ultrasonic coagulation [3] and transection of the sympathetic chain [4] with varying degrees of success. It appears that more aggressive approaches are associated with better results. The recurrence rates reported for sympathectomy are usually lower than that for sympathicotomy [5]. Also, higher recurrence rates of PH were reported after the single-ganglion resection in comparison to two-ganglion resection [5]. It has been considered important to separate the ends of the interrupted sympathetic trunk to reduce the chance of nerve regeneration [6]. There have been also reports stating that satisfaction rates were superior when T2 and T3 resection was done, in comparison to isolated T2 resection [5]. We believe that our technique of thoracoscopic excision of the sympathetic chain is associated with the same excellent outcomes of other "aggressive" approaches.

The described technique is a simple procedure with low complication rate and excellent outcome. There is no need for double-lumen intubation, and elevating the head allows good exposure to the upper sympathetic chain. No chest tubes were needed and our operative time (20 min for unilateral TS) is comparable with the other series [6, 8]. Pneumothorax is the most frequent reported early complication after TS and only needs pleural drainage in 30% of the cases [11]. None of our patients experienced symptoms or signs suggestive of pneumothorax, and visualising full re-expansion of the lung at the end of the procedure, minimizes the risk of this complication.

In our technique only one port (5 mm port for the camera) is needed and the two working instruments are then introduced without ports under direct vision, using the stab technique at a higher level. The authors,however, acknowledge that ports inserted through the anterior and posterior axillary lines might have better long-term cosmetic outcome.

Dry limbs were immediately achieved in all our patients. There was one incidence of mild late recurrence. This patient had undergone right-sided TS followed by contralateral TS 6 months later. During the latter operation, an aberrant nerve of Kuntz was identified and severed. Mild recurrence of right sided sweating was noted on follow-up but, as it did not affect the quality of her life, no further intervention was undertaken. We suspect that we failed to identify an aberrant nerve of Kuntz during the first TS on the right side, accounting for the late recurrence. The Kuntz's nerves are sympathetic fibres that reach the brachial plexus without passing through the sympathetic trunk, and their prevalence varies considerably between surgical and anatomic literature. Clinical studies describe Kuntz's nerve in about 10% of cases, whereas anatomic investigations report Kuntz's nerves in up to 80% [12]. Other series report recurrence rates between 1 and 27% of the patients at 3 years after surgery [13] with 75% of recurrences presenting in the first 6 post-operative months, and its intensity in the majority of cases is moderate. Most of our patients were followed up beyond this point.

Compensatory sweating (CS) is a relatively common side effect after TS. Its rate in some series ranged between 60 and 90% [14–20]. It typically appears after 6 to 12 months, with females being more susceptible and is not related to the extension of the TS [13]. Lin [6] reported a total of 1,140 patients (84%) who have developed compensatory sweating of the trunk and lower limbs, and stated that this discomfort is maximal during the first summer after the operation, but rarely handicaps the patient's life. Yano et al. [5] reported that CS was noted in many patients (90–100%) in the first 6 months post-operatively, and was considered severe in 76% of patients. The intensity of CS did not change in most of their patients and it was thought to be related to hot weather and mental tension.

We assessed the impact of the surgery on our patients' quality of life through a detailed telephone questionnaire emphasising on their satisfaction (at least 1 year after the procedure) and their acceptance of the post-operative

results. This involved direct questioning on the CS and whether or not they think it interferes with their social life. Interestingly in our series, CS was only noted through direct questioning of the patients. Despite the fact that it was present in eight patients none of them spontaneously reported it as a complication. This is similar to other reports in which the patients considered CS as a minor inconvenience when compared to their original problem [3].

The limitations in this preliminary study include a small sample size especially when compared with published adults reports and the subjective nature of the questionnaire, which we tried to compensate for by constructing it in a way that will reflect as accurately as possible the exact patient's satisfaction and the emphasis of the procedure on their social life.

In conclusion, thoracoscopic excision of the sympathetic chain is a simple and safe procedure in children. Satisfactory outcome with relief of hyperhidrosis can be achieved in nearly all cases with significant improvement in quality of life. It allows histological examination of the specimen to confirm complete ablation of the sympathetic chain. Coagulating any lateral communications to the sympathetic chain and avoid missing the Kuntz's nerve are the keys to avoid recurrence. CS is a common problem that is usually well tolerated by the patients.

Acknowledgments I would like to thank my colleagues at Ain Shams University for helping me in collecting the data. I would also like to thank Mr. Gregor Walker (consultant paediatric surgeon, Yorkhill hospital, Glasgow) for his invaluable advice.

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