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Research Article

Sympathetic Ablation for Primary Palmar Hyperhidrosis: Could Controversies be solved?

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Abstract

Excessive perspiration of the palms of unknown etiology is present in a substantial number of the young people. It may cause severe social, emotional and occupational handicaps. A multitude of therapies exist, but sympathetic ablation is the only method that may obtain permanent relief. Sympathectomy, however, is not devoid of consequences, compensatory hyperhidrosis (increase in perspiration in areas of the body unaffected by the sympathetic ablation) is the most important and may attain devastating proportions. With the advent of thoracoscopic surgery, several modifications of the standard T2-T3 ablation were introduced. It was postulated that lowering the level of ablation and reducing its extent would attenuate the amount of compensatory hyperhidrosis. Instead of excision, transection of the sympathetic chain or ganglionic electrocoagulation became popular. Published data are, however, still controversial. To resolve the dilemmas, well designed studies are required, in which only one variable is evaluated, the exact level of ablation is marked (and postoperatively confirmed by chest radiograph), the level of ablation is ganglion, not rib, based, and results are quantitatively assessed. A standard questionnaire for data compilation has been developed by the International Society of Sympathetic Surgery, which is willing to assist and promote such studies.

Introduction

Primary hyperhidrosis is a pathological condition of excessive secretion of the eccrine sweat glands in amounts greater than required for physiological needs [1]. The etiology is unknown but some cases are familial [2]. It usually develops in childhood or adolescence. A rare epidemiological study showed that 0.6-1.0% of young subjects complained of excessive perspiration of varying severities and anatomical locations, a quarter of whom had severe palmar sweating, resulting in serious social, emotional and occupational handicaps [3]. A multitude of therapies have been proposed for the treatment of primary palmar hyperhidrosis (PPHH), however, the only treatment which may permanently abolish palmar hyperhidrosis is sympathetic ablation [4]. Historically, open upper dorsal sympathectomy for PPHH invariably consisted in excising the second and third thoracic ganglia, the second thoracic ganglion being considered the key for sympathetic innervation of the hand [5]. However, this procedure has consequences. Compensatory hyperhidrosis (CH), the development of overperspiration in areas of the body unaffected by the sympathetic ablation, is the most frequent one and may be devastating [6,7]. With the advent of thoracoscopy which greatly simplified the procedure, a plethora of surgical modifications to upper dorsal sympathectomy for PPHH were developed in the search of a method that would reduce the occurrence and degree of CH [8]. These modifications cover (a) the surgical technique (size, number and inlet sites of ports); (b) the level and extent of ablation; (c) the type of ablation (resection, or transection, or thermocoagulation, or clipping of the chain / ganglia / rami communicantes); (d) the desired result of ablation (degree of sweating reduction); (e) the methods by which results are being evaluated. A multitude of contradictory data has been published, further complicating the picture, thus confusing the reader who is seeking to learn how to treat a patient with PPHH. In the present study the literature is reviewed in order to clarify the controversies. Nevertheless, to provide a definitive answer new scientific studies with proper measurements are needed.

Material and Methods

A search of the literature was performed in MedLine, using the terms Primary Palmar Hyperhidrosis AND Sympathectomy / Sympathicotomy / Sympathetic Ablation AND Compensatory Hyperhidrosis, for the years 1990-2014 included (the years in which endoscopic sympathectomy was unequivocally adopted). All articles relevant to palmar hyperhidrosis were examined and additional earlier publications were also retrieved. The retrieved articles were compiled into three groups, concerning the surgical technique, the level and extent of ablation, and the type of ablation. The resulting CH was examined, as well as the methods by which its degree was estimated.

Results and Discussion

The surgical technique

In the era of open surgery, the ganglia were excised. With the advent of endoscopic surgery, modifications became possible. It is awkward to excise the ganglia using a single working instrument. This requires superior technical surgical ability, untoward mishaps like damaging a blood vessel are more likely to occur, and it is more time consuming. In comparison, electrocoagulating a ganglion, transecting the chain by diathermy, or clipping these structures may quickly and easily be performed using even one port. These advantages are probably one of the reasons that led to the technical modifications.

The level and extent of ablation

Originally, resection of the, C8/T1 (stellate) and T2 ganglia was thought to be required in order to sympathetically denervate the upper limb [9,10]. Later, ablation of the T2 ganglion alone was considered sufficient to obtain complete sympathetic denervation of the hand [5,11].

Despite these considerations, resection of T3 was often performed in addition to T2 [3]. Surgeons then came to believe that lowering the level of ablation would reduce the incidence of CH, and this became applicable when endoscopic techniques were introduced (i.e. approaching the chain from below rather than from above).

Lowering the Level

The belief that lowering the level reduced CH may have arisen almost by accident. In one study the authors twice mistook the level of sympathectomy, but were nevertheless successful in attenuating PPHH while reducing the incidence and severity of CH [12]. Their approach was rapidly adopted by several surgeons. However, reports continued to be published and a review of the literature for the years 1990-2006, did not confirm this hypothesis [13]. One subsequent article, entitled an "Expert Consensus" reviewed the literature from 1991-2009 and concluded that lowering the level of ablation was appropriate but was based on only ten selected studies out of 102 clinical trials [14]. Furthermore, contradictory reports continued to be published. Three recent publications have reported reduced CH by lowering the level of ablation [15,16,17] but four other studies contradict this conclusion [18,19,20.21].

Restricting the Extent (the number of ablated ganglia)

Similarly to the level of resection, limiting the amount remains controversial. Some studies suggest that ablating more than one ganglion tends toward a higher incidence of CH [22,23,24]. However a recent study comparing four groups of patients who underwent T2-3, T2-4, T2-5, T2-6 ablations resulted in no statistical difference in the incidence of CH [25].

Thus the subject remains controversial. However, a trend may be detected, namely that lowering the level of ablation reduces the resulting CH, but increases residual palmar sweating [26,27].

The type of ablation

In the review published in 2008 [13], no less than 42 different methods of sympathetic ablation were identified, and more have been published later. It is unfeasible to evaluate each of these methods. The few comparative studies provide contradictory data. Excising the sympathetic ganglia achieves the most extensive denervation. Transecting the chain (sympathicotomy / sympathotomy) or electrocoagulating ganglia apparently preserves some innervation, as proven by physiological studies of cardio-respiratory function [28]. If the degree of CH depends on the degree of denervation, it is logical that lesser denervation will cause less CH. This has been confirmed in some studies [29,30]. However, in another study no statistically valid difference was observed [31]. Furthermore, the attempt to reduce CH by less traumatic ablations has a price: a higher rate of recurrence [32].

Evaluation of results and recommendations

Design of studies

Comparative studies should be organized so that only one variable exists between the groups that are compared, and the groups themselves should not contain variables. So for example in one study T2-3 sympathectomies (excision of ganglia) were compared to T3-4 sympathicotomies (transection of the sympathetic chain) [33] and in each group there were patients with variable symptoms (palmary and axillary sweating). So the reader is unable to decide to which variable (the level or the method of ablation) the differences are to be attributed, and the different indication further blurred the results.

Compilation of data

When coming to overview the literature, it is often impossible to compile results of studies because data are collected by different questionnaires. This makes meta-analysis almost impossible. To overcome this problem, the International Society of Sympathetic Surgery (ISSS) has developed a standard questionnaire which is appended on the website of the Society (www.isss.net; enter "About ISSS", and then "Recommendations").

Requirements

To allow comparison, the following data are required:

a. Precise level of ablation: To positively identify the level, a metallic clip is placed during surgery and its position confirmed by postoperative chest radiography. Mistaken estimations have occurred and been published [12,34]. The reason for these is the common belief that the first rib is not visible during thoracoscopy [35], but in another study the first rib was visible during thoracoscopy in about half of the patients and was palpable in the rest [36].

b. Precise anatomical orientation: The level of ablation is presented in the various publications either by rib count (R), segmental-vertebral level (T for the thoracic chain), or by designing specifically the ganglion (G). In most studies, the level of ablation is estimated by counting the ribs. However, it is the ganglia which are the sympathetic supply of the upper limb and their anatomy is variable. In an anatomical study, 9.1% of T2 ganglia were fused with the stellate ganglion, only 50% were in the second intercostal space, 20% were located over the upper border of the third rib and 6% were found over the third rib [37]. This downward trend of location increases with the T3 and even more with the T4 ganglia [37]. Therefore, the level of surgery should be documented using anatomical visualization and localization of the ganglia (G), not by rib count (R). Identification of the ganglia was perhaps easier in the era of open surgery, but is still possible with the laparoscopic approach if the pleura over the upper sympathetic chain are opened. It is obvious that in certain cases, exactly identifying the ganglia may be difficult, in which cases, performing the ablation by rib orientation remains always an option.

c. Standardization: The method of reporting sympathetic ablations has been standardized and is reported in the ISSS web site. However, additional standardization is still required. In the past, the standard goal of sympathetic ablation was obtaining dry palms. With the regression from G2 to lower ablations, residual moisture in the palms is considered by many authors as "acceptable". It is true that normal palms are not completely dry, but there is no quantitave study to decide what should be considered "normal". Furthermore, there is no way to estimate what is the exact method of ablation to obtain the "desired" amount of residual palmar moisture.

QoL Questionnaires vs. Metrics

Results are evaluated in most articles by obtaining patients' satisfaction. Several Quality of Life (QoL) questionnaires have been developed [38,39,40,41,42]. Patient satisfaction is no doubt very important. However, this is a subjective evaluation, depending on several factors like the preoperative degree of oversweating, the occupation of the patient, and the temperature in which the patient is working. Obviously, patients with more severe sweating pre-operatively will report the highest postoperative improvement by QoL questionnaire (43). The same degree of residual palmar sweating will affect differently a clerk with office activities compared to one with limited manual activity, or a person working outdoors in a hot humid climate versus one working in air conditioned indoors facilities. Although important and clinically practical, studies based on patient

satisfaction lack a scientific basis. Such studies cannot supply information about the degree (percentage) of perspiration reduction obtained by the various methods, of ablation or level of ablation. Therefore, an objective test is required to measure pre- and post operative sweating. Several metric methods and instruments have been developed: skin resistance (conductance) (44), ventilated capsule technique (45), evaporimetry (humidity and temperature) (46), electrical measurements of sweat activity (47), weight loss (for total body amount of perspiration) (48), and sudometry/gravimetry (transepidermal water loss) (49), and have all been advocated. The use of metrics will allow in future studies to obtain an objective, valuable, and scientifically based instrument in evaluating results.

Conclusions

Many of the existing controversies are solvable. In our opinion, to overcome the disagreements, properly designed studies and objective evaluations are required. In order to solve some of the controversies and promote scientific evaluation, one of the main topics to be discussed in the next International Symposium on Sympathetic Surgery (Santiago de Chile, 15-17 October 2015) will be to examine the assistance that ISSS may offer to future potential investigators in designing studies.

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