Bilateral simultaneous thoracoscopic sympathectomy in prone position for treatment of palmar and axillo-palmar hyperhydrosis , safety and feasibility

Thesis
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By

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Contents

List of abbreviations

- Ach Acetylcholine
- ANS Autonomic nervous system
- AR Ascending rami
- BTX Botulinum toxin
- DLT Double lumen tube
- DR Descending rami
- ETOH Ethanol
- FD Familial dysautonomia
- HDSS Hyperhydrosis disease severity score
- KN Nerve of Kuntz
- NPS Nail-patella syndrome
- SLT Single lumen tube
- VATS Video assisted thoracoscopic surgery

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ABSTRACT

Many lines of treatment are available such as topical medications, ion topheresis, systemic medications, botulinum toxin type A (BTX-A), and surgery. Patients should generally start with the least invasive form of therapy and progress to more complicated therapies when other therapies fail. Severe hyperhydrosis and cases where other treatments fail has been treated with thoracoscopic sympathectomy. Different approaches and techniques are available for thoracoscopic sympathectomy. Posterior bilateral simultaneous approach in prone position is considered one of the best choices. It has the same or even better results than unilateral staged approaches. Resection of the third and/or fourth sympathetic ganglia has the best results in literature for management of this condition. Nevertheless, transection of the sympathetic chain without excision has comparable results. This has to be confirmed by further prospective studies and long- term follow up periods.

Keywords:

Bilateral simultaneous

Thoracoscopic sympathectomy

Palmar and axillo-palmar hyperhydrosis Safety and feasibility

Introduction

Introduction

Hyperhydrosis is defined as excessive sweating as a result of increased production by the exocrine cutaneous glands. The most commonly affected areas of the body are hands, axillae and feet. Hyperhydrosis in its severe form frequently produces psychological, social, and professional problems for the affected patient **(Gordon et al., 1994).**

Hyperhydrosis can be primary or secondary. Primary hyperhydrosis is idiopathic in nature and the most commonly affected areas of the body are hands, axillae, and feet . Primary hyperhydrosis affects between 0.5 and 1% of the population **(Ro et al., 2002).**

Causes of Secondary hyperhydrosis are generally related to systemic conditions, the most common being endocrine abnormalities. Other common causes of secondary hyperhydrosis include febrile illness, neurological disorders, spinal cord injury, and diabetes **(Strutton et al., 2004).**

Hyperhydrosis, can be extremely disabling. The stress associated with the sweating frequently leads to additional anxiety and a subsequent increase in sweating, which only exacerbates the condition **(Cina and Clase, 1999).**

Although many treatments are available, they usually provide little benefit and adequate treatment is often frustrating to both physician and patient alike. Patients should generally start with the least invasive form of therapy and progress to more complicated therapies when other

therapies fail. Approved therapies include topical medications, iontopheresis, systemic medications, botulinum toxin type A (BTX-A), and surgery. Severe hyperhidrosis refractory to medical therapy has been treated with thoracoscopic sympathectomy using standard thoracoscopic instrumentation. The long-term results of thoracoscopic sympathectomy have been proven to provide durable, long-term cessation of excessive sweating. It is currently accepted that thoracoscopic sympathectomy is the treatment of choice for sympathetic hyperactivity **(Stolman, 1998).**

Review of literature

Review of literature

Sweating and hyperhydrosis

Sweating is a normal physiological response to reduce body temperature. The surface of the body is covered with sweat glands of two types; eccrine and apocrine. Eccrine sweat glands secrete a clear odorless fluid that serves to aid thermoregulation by evaporation. Eccrine glands are widespread but present in higher density on the soles of the feet, forehead, and palms. Apocrine sweat glands are restricted to the axillae and groin. Apocrine glands produce a thick fluid that undergoes bacterial decomposition to produce a strong odor. The thermoregulatory center in the hypothalamus controls body temperature by regulating blood flow to the skin and eccrine sweat glands **(Hurley, 1992).**

Eccrine sweat glands are smaller than apocrine sweat glands, and are distributed all over the body surface but not on the lips, external ear canal, clitoris, or labia minora. These glands secrete hypotonic sweat consisting mostly of water and electrolytes. Their main function is the control of body temperature . Eccrine sweat gland is a single tubular structure consisting of a secretory portion and a ductal portion. The ductal portion consists of a coiled duct, an intradermal straight duct, and an intra-epidermal duct (the acrosyringium). The secretory portion looks globular because of its coiled structure. It consists of three types of cells; dark secretory cells, clear secretory cells, and myoepithelial cells. Myoepithelial cells surround secretory cells. **(Montagna et al., 1953).**

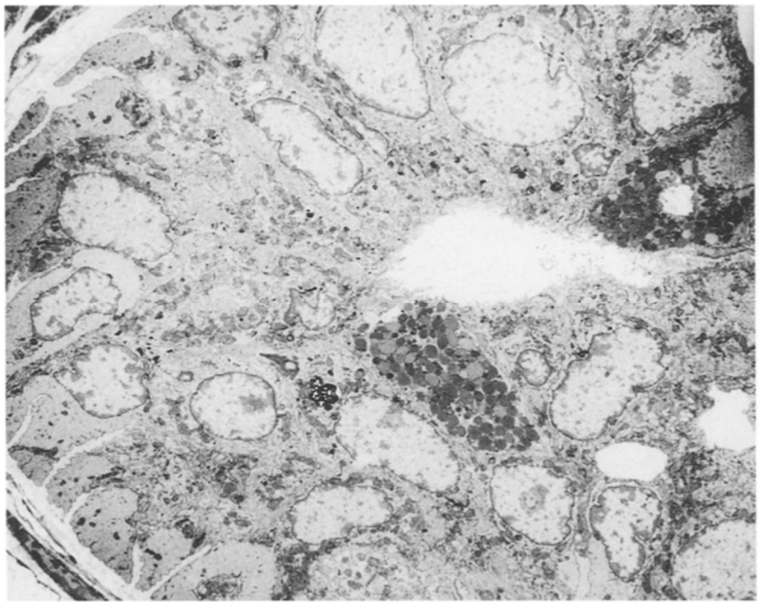

Fig. 1. Electron micrograph of the secretory portion of eccrine sweat glands. (1500 ×) **(Sato et al., 1987).**

Apocrine sweat glands are different from eccrine sweat glands in structure and function. They are larger than eccrine ones. They are distributed on the axillae, areola of nipple, and genital areas. Apocrine sweat glands become active at puberty and secrete "proteinaceous" viscous sweat which has unique odor. Apocrine sweat glands are a remnant of an odorous organ. They are composed of three segments; the secretory portion, the intradermal duct, and the intraepithelial duct. Ducts of apocrine sweat glands open to hair follicles whereas ducts of eccrine sweat glands open to the surface of the skin through the epidermis **(Robertshaw ,1991).**

A third type of human sweat gland was accidentally discovered by **Sato et al.,** When they were dissecting sweat glands from a piece of axillary skin obtained from surgery for hyperhydrosis, they found unclassifiable sweat glands, that is neither eccrine nor apocrine sweat glands under stereo-microscope. These glands varied in size but were

larger than eccrine glands and smaller than apocrine glands dissected from the same skin specimen. It was decided to call them "apoeccrine" because these glands share some of the morphologic and functional features with both eccrine and apocrine glands **(Sato et al., 1987).**

The apoeccrine gland has a long duct that opens directly onto the skin surface like the eccrine sweat duct . The secretory portion of apoeccrine glands is irregularly dilated. In some glands only a short segment is dilated like a balloon, but sometimes the entire length of the secretory tubule is irregularly dilated. Interestingly, it was found that the dilated segment consisted of an apocrine-like single layer of epithelium which showed so-called decapitation secretion, whereas the undilated segment showed the ultrastructural features typical of the eccrine secretory portion consisting of clear and dark secretory cells. When the dilated segments of the apoeccrine sweat glands were cannulated and stimulated in vitro, they yielded an abundant serous sweat secretion in response to both methacholine and epinephrine, suggesting that apoeccrine sweat glands may contribute to axillary sweating in adults. The apoeccrine glands appear to develop during puberty from the eccrine glands, or eccrine-like precursor glands because apoeccrine sweat glands are not found before puberty **(Sato and Sato, 1987).**

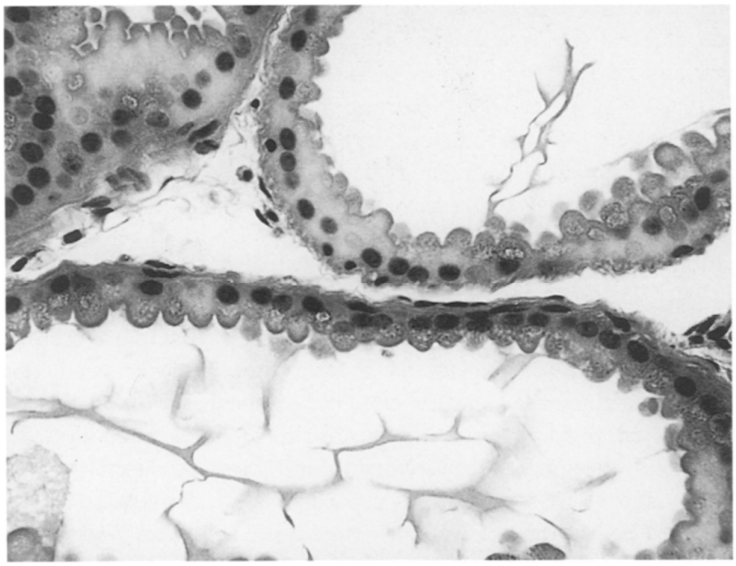

Fig.2 Hematoxylin-eosin stained section of the secretory portion of apocrine sweat glands . (340 X)
(Sato et al., 1987)

Control of sweat secretion in central nervous system

Body temperature is precisely controlled in mammals. When body temperature is increased, sweating occurs at and above a certain core temperature. This indicates the presence of a thermo-sensitive sweat center. The preoptic area and anterior hypothalamus contain many thermo-sensitive neurons that detect changes in core temperature and initiate appropriate responses to keep body temperature constant **(Boulant, 1981).** The activity of this sweat center increases not only with an increase in the local pre-optic temperature but also with an increase in afferent impulses from the cutaneous and spinal thermo-receptors caused by an elevation of the skin temperature . An increase in core temperature is about nine times more efficient than that of the mean skin temperature in stimulating the sweat center and the sweat rate. Therefore the increase in core temperature is a major determinant of sweat secretion whereas the skin surface temperature plays a relatively minor role in activation of sudomotor activity **(Nadel et al., 1971).**

Control of sweat secretion in the autonomic nervous system

Postganglionic sympathetic non-myelinated C fibers surround sweat glands. In contrast to the ordinary sympathetic innervation, acetylcholine is the main neurotransmitter secreted from the sympathetic nerve terminals surrounding eccrine sweat glands. The human sweat glands had been believed to be innervated only with postganglionic cholinergic fibers **(Dale and Feldberg, 1934).**

It was demonstrated that both adrenergic and cholinergic nerves exist in periglandular area of human eccrine sweat glands. A fluorescence histochemical technique (Falck-Hillarp method) demonstrated catecholamines in periglandular nerves of eccrine and apocrine sweat glands. Freeze-dried sections were incubated with humid formaldehyde at 80°C. This process converts catecholamines in the tissue to dihydroisoquinoline which fluoresces with a greenish-yellow color when excited with ultraviolet light near 400 nm **(Uno and Montagna, 1975 and Falck, 1962).**

Electron microscopy showed many unmyelinated varicose axon profiles in the vicinity of both eccrine and apocrine sweat glands. Most of these profiles contained many small agranular and a few large dense-cored vesicles (cholinergic terminals). Other profiles had small and large dense-cored vesicles (adrenergic terminals). These observations suggest that large numbers of cholinergic terminals and a few adrenergic terminals innervate the sweat glands of human beings **(Uno,1977).**

Drugs like, 6-hydroxydopamine and 5-hydroxydopamine have specific effects on the metabolic pathways leading to catecholamine synthesis and release. 6-hydroxydopamine depletes endogenous catecholamines from