

# Axillary hyperhidrosis treatment update

## Atualização no tratamento de hiperidrose axilar

### ABSTRACT

**Introduction:** Axillary hyperhidrosis is a common problem that can affect sufferers' personal and professional lives. Clinical histories and physical examinations are important tools to assess the severity of the condition and to indicate the most appropriate therapy for each case. There are a number of treatments for axillary hyperhidrosis, including topical and systemic therapy, iontophoresis, botulinum toxin, and surgical procedures. The authors have conducted a review of the most important treatments.

**Keywords:** hyperhidrosis; ambulatory surgical procedures; botulinum toxins; laser therapy; therapeutical approaches

### RESUMO

**Introdução:** Hiperidrose axilar é problema comum que pode afetar a vida profissional e social. A história clínica e o exame físico são ferramentas importantes na avaliação da gravidade e para indicação da terapia mais apropriada para cada caso. Existem vários tratamentos, incluindo terapia tópic e sistêmica, iontoforese, toxina botulínica e procedimentos cirúrgicos. Os autores apresentam revisão das opções terapêuticas mais importantes.

**Palavras-chave:** hiperidrose; procedimentos cirúrgicos ambulatoriais; toxinas botulínicas; terapia a laser; condutas terapêuticas.

### INTRODUCTION

The human skin has countless eccrine glands which secrete the fluid known as sweat. Sudoresis (profuse sweating) helps in eliminating heat and in balancing body temperature. Hyperhidrosis is a disorder characterized by the excessive production of sweat. Hyperhidrosis can be focal (localized), when it involves specific areas of the body, or generalized when it involves the whole body. Generalized hyperhidrosis can have a physiological cause or be linked to an autonomic dysfunction secondary to neurological, endocrinological, or metabolic disorders, feverish disorders, malignancies and medications.<sup>1-4</sup>

Focal hyperhidrosis is usually localized and symmetrical, manifesting more frequently in the axillae, hands, feet, and face.<sup>1,2</sup> Eccrine glands are distributed all over the body, with a greater concentration in the palmoplantar and forehead regions, being innervated by cholinergic fibers of the sympathetic nervous system. The physiopathology of focal hyperhidrosis is little understood. Affected patients do not present any histological alteration or change in the number of eccrine glands.<sup>1,3,5</sup>

The most probable cause of focal hyperhidrosis is the neurogenic hyperexcitability or overactivity of the reflex circuits involving normal eccrine glands. Such hyperexcitability can be caused by a complex dysfunction of the sympathetic and parasympathetic routes of the autonomous systems. In addition, many patients present an exaggerated response to physical and emotional stimuli, as well as to increases in temperature.<sup>1,3,5-7</sup>

## Review Article

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Approximately two-thirds of patients describe a positive family history, suggesting the influence of genetic factors.<sup>1</sup> In the USA, a comprehensive epidemiological study showed that 2.8% of the population suffer from hyperhidrosis, and nearly half of that percentage report axillary hyperhidrosis. Of the half reporting axillary hyperhidrosis, one-third present with serious hyperhidrosis, with symptoms that frequently or permanently interfere in daily activities and are considered by patients as intolerable or almost intolerable.<sup>2,8,9</sup>

Focal hyperhidrosis can lead to a wide range of secondary medical conditions, such as bacterial or fungal supergrowth, muscular cramps, eczematous dermatitis and other dermatological conditions, in addition to anxiety and other psychological disorders. However, patients deem the impact on quality of life as the most important factor.<sup>7</sup> Hyperhidrosis can have significant effects on patients, interfering with their social, professional and daily relationships, causing a negative impact on quality of life, and potentially leading to social stigmatization.<sup>1,2,10</sup>

For practical diagnostic purposes, each patient's personal situation should be considered, meaning that any sudoresis that significantly interferes with the patient's daily life (physically or psychologically, either in the social or professional spheres) should be treated as abnormal.<sup>3,5</sup>

The Hyperhidrosis Disease Severity Scale (HDSS) is specifically used for that disorder, providing a qualitative measure of the condition's severity, based on how it affects patients' daily activities. Patients select statements that best reflect their experience with hyperhidrosis in each of the areas being assessed (Table 1).

Scores of 3 and 4 indicate serious hyperhidrosis, while scores of 1 and 2 indicate mild or moderate hyperhidrosis. HDSS is a practical, simple, and easy-to-understand diagnostic tool that can be quickly implemented and has shown good correlation with other types of questionnaire. A point of improvement in this scale is associated with a 50% reduction in the production of sweat, while two points are associated with an 80% reduction.<sup>1</sup>

AXILLARY HYPERHIDROSIS TREATMENTS

Topical treatment

Aluminum chloride and aluminum chlorohydrate salts are the most common topical treatments for axillary hyperhidrosis. Used in different concentrations – but never above 20% – the salts form a compound with mucopolysaccharides, generating a precipitate that presumably blocks the epidermal ducts or promotes the atrophy and vacuolation of glandular cells.<sup>5,11</sup>

Usually, the product containing the salts is applied daily on dry skin (occlusion is recommended for better results) at night-

time and washed off in the morning. As symptoms improve, use is decreased. Common side effects are a burning sensation and irritation. They occur mainly in the presence of high concentrations and can limit the benefits of the treatment.<sup>5,11</sup> Other topical products, such as aldehydes, anesthetics, and anticholinergics, were investigated, but without showing significant benefits.<sup>5</sup>

Iontophoresis

Iontophoresis involves the introduction of ionized particles into the skin by means of an electric current in a liquid element (usually pure water). The exact action mechanism is unknown, however, it is believed that iontophoresis either stimulates the occlusion of glandular ducts or affects the electrochemical gradient of sudoral secretion, or can promote a feedback mechanism.<sup>5,11</sup>

It can cause skin dryness, desquamation and fissures in the treated site, especially in the axillae, and this limits its use in that area. Treatment is contraindicated in pregnant women, patients with a pacemaker or large metallic prostheses, and epilepsy sufferers.<sup>5,11</sup>

Systemic treatment

The use of oral anticholinergics, such as atropine and glycopyrrolate, is limited by the frequent presence of side effects, such as oral and ocular dryness, constipation, and difficulty in urination. This type of treatment would, however, be suitable in cases which do not respond to topical treatments, iontophoresis, or botulinum toxin.<sup>11</sup> In spite of the side effects, the use of anticholinergic agents is recommended before considering surgical intervention.<sup>1</sup>

Botulinum toxin

Botulinum toxin Type A is known for being able to block sympathetic, post-ganglionic cholinergic fibers in the area where sudoriparous glands are located. It has been used in the treatment of focal hyperhidrosis since the 1990s and several studies have demonstrated its efficacy, safety, and good tolerability as an alternative to topical, systemic, and surgical treatments.<sup>2,5</sup> The US Food and Drug Administration (FDA) currently approves the use of type A botulinum toxin as a therapy to treat axillary hyperhidrosis only.<sup>5,11</sup>

Although many studies have shown that doses > 50 units per axilla lead to little significant improvement, 50–100 units per axilla are frequently used. It is recommended that tests involving painting the affected area with iodine dye, followed by powdering the affected area with starch, are carried out prior to the procedure, as the emergence of blue-black staining indicates the presence and location of sudoresis (Minor test; Figure 1).

Table 1: Hyperhidrosis Disease Severity Scale.

My axillae's sweat is never noticed and never interferes with my daily activities.	Score 1
My axillae's sweat is tolerable, but sometimes interferes with my daily activities.	Score 2
My axillae's sweat is almost intolerable and frequently interferes with my daily activities.	Score 3
My axillae's sweat is intolerable and always interferes with my daily activities.	Score 4

For better results, patients should discontinue the use of antiperspirants or other topical treatments 5 days before the Minor test. Several intradermal injections are applied at intervals of approximately 1.5 cm. These injections can be made into the superficial adipose tissue without adverse effects or significant reduction in efficacy.<sup>5</sup>

There are no restrictions in patients' daily life and activities after the procedure. The toxin's action usually starts to take effect after 7–10 days and can last from 6 to 8 months. The pain associated with the procedure is usually minimal, with a considerable improvement in quality of life after treatment and no significant side effects having been described.<sup>5</sup> Recent research indicated that no immunological alterations were found in the skin of patients with axillary hyperhidrosis treated with botulinum toxin.<sup>12</sup>

## SURGICAL PROCEDURES

When clinical options do not offer satisfactory results, a variety of surgical procedures, including thoracic and localized surgery (sympathectomy), can be used.

### Sympathectomy

Sympathectomy can be carried out non-surgically, using a phenol or alcohol injection guided by computerized tomography. Surgical intervention can be carried out through open or endoscopic techniques (the latter being more popular). In endoscopic sympathectomy, the sympathetic ganglia are destroyed by excision, ablation or clipping. This modality has been used more frequently to treat palmar hyperhidrosis with high success rates. The main problem associated to sympathectomy for focal hyperhidrosis is the high incidence rate of compensatory sudoresis in other regions of the body (around 88%).<sup>5</sup> Compensatory sudoresis typically starts between 2 and 8 weeks after surgery, frequently in mild form, however, there have been reports of severe cases affecting a great number of patients, and this can greatly reduce the satisfaction indices associated to the procedure. In addition to compensatory hyperhidrosis, complications include paresthesia of the chest wall (approximately 50%), pneumothorax (7%), Horner's syndrome (< 1%), hemo-

thorax (< 1%), and rare cases of cardiac arrest or arrhythmias.<sup>5</sup>

The patient satisfaction index is lower when sympathectomy is carried out to treat axillary hyperhidrosis when compared to palmoplantar hyperhidrosis.<sup>13</sup>

### Localized surgery

Localized surgery can be used to treat axillary hyperhidrosis and can be carried out under local anesthesia, with or without the systemic administration of an anxiolytic agent. Patients usually undergo delineation of the axillary region by means of the Minor test, and this is followed by the injection of local anesthesia with vasoconstrictor (tumescent or not).<sup>14</sup>

In all techniques, the target is the complete removal of the glandular structures of the subcutaneous tissue and deep dermis.<sup>15</sup> Disadvantages include the potential for scars, partial alopecia, or hyperpigmentation. Ecchymosis, partial alopecia, and pain can occur as self-limiting or short-term effects. With surgeons becoming more experienced and with techniques, medical equipment and technology being developed further, the appeal of using such procedures to treat axillary hyperhidrosis has increased substantially, bringing improved results and resulting in fewer complications.<sup>14</sup>

Some authors suggest classifying localized surgery for axillary hyperhidrosis into three main groups:

Axillary skin and adjacent tissue resection (the most radical type of surgery)

Subcutaneous removal of tissue without excision of the skin (incision to access the subcutaneous glandular tissue only; less invasive) with:

Open curettage, with visualization of the curetted tissue

'Blind' curettage, without direct visualization of the curetted tissue (e.g. liposuction with curettage, ablation with laser through an optical fiber)

Combination of the two methods, resulting in the partial resection of the skin with the combined removal of the subcutaneous tissue and adjacent tissues.<sup>15</sup>

### Skin and subcutaneous resection

Since 1963, when the first study recommending elliptic excision was published, many excisional techniques to remove or modify the sweat-producing tissue of the axilla have been described. Success rates have ranged from 50 to 90%. Case reports have shown that excisional surgery, at any depth in the skin, can suffer from complications caused by infection, bleeding, delayed healing, necrosis, poor healing, or cicatricial contracture. Scars and restriction in movement remain the most important complications when using this kind of invasive surgery.<sup>5</sup>

While some authors believe that radical surgery is more effective, others describe minimally invasive techniques (such as liposuction with curettage) as equally good, leading to better aesthetic results and fewer complications.<sup>15</sup>

### Removal of subcutaneous tissue without skin excision

If a minimally invasive approach is chosen, there is consensus that the final condition of the axillary skin must be similar



**Figure 1:** Hyperhidrosis area evidenced by means of the Minor test

to that of a total skin graft, obtaining maximum removal of the sudoriparous glands.<sup>13,15,16</sup>

The removal of glandular tissue through curettage or ablation can be carried out in a 'blind' manner (i.e. without visual control; e.g. liposuction with curettage) or with visual control – usually with the eversion of the surgical wound borders to allow visualization of the glandular tissue.

#### ***Liposuction with curettage***

With the aim of reducing the postoperative morbidity associated with excisional techniques, Jemec<sup>17</sup> proposed the subcutaneous curettage of the axillary area. The curettage is carried out under the skin through a small excision, in an attempt to destroy the area's eccrine glandular tissue. Jemec's study describes a high efficacy level, with 17 of 20 patients reaching significant improvement. Since the end of the 1980s, axillary liposuction has been recommended to destroy and remove glandular tissue, with acceptable efficacy and fewer side effects than traditional surgical techniques.<sup>5</sup>

Several studies reported high satisfaction rates when liposuction with curettage was used, usually presenting clinical improvement of hyperhidrosis in at least 80% of patients, with minimal adverse effects, speedy return to daily routine, and resulting in almost undetectable scars.<sup>9,18,19</sup> Although rarely in a complete fashion, hyperhidrosis can recur in some cases.<sup>9</sup> Adverse effects, including ecchymoses, minor local infections, mild cutaneous erosions, loss of axillary hairs, temporary paresthesia, seromas, hematomas, desquamation, and low-intensity postoperative pain, were minimal in all studies.<sup>9,16,18,19</sup>

The efficacy of liposuction with curettage is ratified when the aspirate obtained during surgery is analyzed – when normal or destroyed glands, as well as portions of conjunctive tissue, are found – showing that the procedure is effective in removing the glands, as well as allowing the curettage of the deep dermis.<sup>15</sup>

Studies showed that sharp holes cannulas can be as effective as the incisions made with scissors, with some studies showing that blunt tip cannulas are less effective in axillary hyperhidrosis surgery.<sup>15,16,20,21</sup>

Some authors suggested that manual curettage is carried out after liposuction with curettage, aiming at a more complete removal of the glands,<sup>19</sup> while others concluded that the use of aggressive curettage after liposuction with curettage increased the rate of complications and, when compared to liposuction with isolated curettage, did not optimize the improvement in sudoresis.<sup>22</sup>

Less experienced surgeons must be careful, avoiding curettage's excessive aggressiveness, which can result in cutaneous necrosis. Several end points were described that are likely to indicate when curettage should be stopped. Those end points include: complete elevation of the axillary skin over the subcutaneous adipose tissue, minor lividness of the axillary skin, rolling 'skin to skin' that allows the palpation of hair follicles, and the sound made by suction via the cannula (indicating the complete dissection of adipose tissue and dermis).<sup>16</sup>

While liposuction with curettage shows high rates of sudoresis reduction, with stable results at the 1 year follow-up,

patients with milder hyperhidrosis do not present significant improvement when treated with liposuction with curettage.<sup>23</sup>

In cases of therapeutic failure or recurrence after liposuction with curettage, the procedure can be repeated with good probability of improvement and few complications.<sup>16</sup>

#### ***Laser ablation of glandular tissue***

There are few scientific descriptions of the use of laser in the ablation of axillary glandular tissue when treating hyperhidrosis. In a recent study, 17 patients with axillary hyperhidrosis were treated with 1064 nm Nd-YAG pulsed laser. The laser was introduced into the subcutaneous tissue through a 300 mm optical fiber inserted in the skin through a 18G disposable epidural needle. The tip of the optical fiber extended 2 mm beyond the needle's end tip. Although the procedure is well tolerated and causes little discomfort, preoperative sedation can be carried out. After the injection of anesthetic, one or more incisions are made in the axillary region 3 cm from the treated area, whenever possible. After adequately protecting the eyes of the patient and of the medical team, the needle is inserted through the incisions, creating subcutaneous channels. The needle containing the laser is moved within the tissue in direct contact with the dermis to reach the sudoriparous glands. It is important that the needle is moved slowly (approximately 1–2 cm/s). The treated area usually exceeds the area determined by the Minor test by 3 cm. Treatment duration is short (average: 30 min). Cold compresses or cooled air are applied before, during, and after the procedure to minimize postoperative edema and discomfort, and to reduce the possibility of skin burns. A non-adhesive, non-compressive bandage is left on for 24 h. The postoperative period was well tolerated in all patients, without pain or significant discomfort. Side effects, including edema, small burns and seroma, were limited, mild, and temporary. The patient satisfaction index exceeded 80%.<sup>24</sup>

#### ***Combined surgery (partial resection with removal of glandular tissue)***

After demarcation of the affected area (for example, using the Minor test), a deep elliptical excision is made in the center of the demarcated area, down to the adipose tissue. The remaining axillary skin delimiting the hyperhidrotic area is detached. The wound's borders are everted and the glandular tissue is removed by ablation, curettage or using surgical scissors. After the procedure, the tissue is sutured both deeply and superficially. In some cases, deep stitches reaching the muscular fascia can be made to better accommodate and anchor the axillary tissue, reducing the risk of seromas and hematomas. Occlusive dressing is left on for 24 h. In 15 patients, a 65% average reduction in sweating with long-term results and minimum adverse effects was obtained when using this technique.<sup>25</sup>

## **DISCUSSION**

A Canadian committee has developed an algorithm that takes into account the severity and location of the disorder. It was recommended that mild axillary hyperhidrosis is initially treated topically with aluminum salts. Botulinum toxin should



be the second-line therapy in cases that do not respond to aluminum salts. In severe cases of axillary hyperhidrosis, botulinum toxin and topical aluminum chloride are first-line therapies, with local axillary surgery being considered after failure of other therapeutic options and before undergoing endoscopic thoracic surgery.<sup>1,11</sup>

With regard to localized surgical methods, combined surgery and liposuction with curettage proved effective, with high patient satisfaction indices and a good safety profile. Compensatory hyperhidrosis did not occur and, in most cases, complications were minimal and transient.<sup>9</sup> Nonetheless, combined surgery presents some disadvantages. Wide and deep excisions need subcutaneous drainage for 1–2 days. Possible risks in the acute postoperative phase are hematoma, seroma, pain, and infection. Atrophic or hypertrophic scars can occur subsequently.<sup>9,26</sup> This is a more invasive method that results in longer hos-

pitalization, higher incidence of local infection, and can result in additional surgery due to complications. However, it has also proved more effective than liposuction with curettage in permanently reducing hyperhidrosis. Nevertheless, ease of execution, the minimum degree of invasion and scar formation, and the good results using liposuction with curettage are the significant advantages of opting for excisional surgery. Therefore, liposuction with curettage has been suggested by several authors as the primary surgical treatment of choice for axillary hyperhidrosis.<sup>9</sup> With regard to laser treatment, in spite of the good results obtained in some studies, there is a lack of more sophisticated studies showing the method's effectiveness and safety profile.

Additionally, localized surgical methods also present good results in the treatment of axillary bromhidrosis – especially when accompanied by hyperhidrosis – justifying its use in these conditions.<sup>23,27</sup> ●

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