

# Treatment of Axillary Hyperhidrosis: Combination of the Starch-Iodine Test with the Tumescent Liposuction Technique

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**OBJECTIVE.** To evaluate and permanently improve axillary hyperhidrosis.

**BACKGROUND.** Excessive sweating of the axillae is a common problem for which patients frequently seek dermatologic advice and therapy. Many treatments, including aluminum chloride, topical and systemic anticholinergic agents, tranquilizers, iontophoresis, direct surgical excision, botulinum toxin injection, and thoracic sympathectomy, have been employed to control this problem. All have drawbacks of one sort or another.

**METHODS.** The starch-iodine technique for delineation of preoperative and postoperative axillary sweating is described in detail. A method of sweat gland removal utilizing tumescent liposuction is discussed.

**RESULTS AND CONCLUSION.** The combination of the starch-iodine technique and tumescent liposuction is safe and effective for therapy of axillary hyperhidrosis.

ONE OF MY patients, a college professor, was aware that each day his students would place bets as to the likelihood that his axillary sweat stain would reach his belt line before the bell would ring at the end of the lecture! Needless to say, his self-confidence, likelihood of achieving a promotion, and ability to teach were severely tested. For those possessing this malady, however, axillary hyperhidrosis is no laughing matter. Hyperhidrosis, though subjective, may be defined as sweating in excess of physiologic needs.<sup>1</sup>

Various authors attribute axillary hyperhidrosis to excessive sweating of both the eccrine sweat glands<sup>2</sup> and apocrine sweat glands.<sup>3</sup> Both of these glands can be stimulated by sympathetic nerve impulses.<sup>4</sup> Though apocrine glands are much larger, both are situated at the junction of the dermis and subcutaneous fat or in the upper subcutaneous fat layer.<sup>3</sup>

I describe the use of the starch-iodine test for preoperative workup and postoperative evaluation of results with the tumescent liposuction technique for treatment of axillary sweating.

## Therapeutic Methods

### Medical Therapy

The majority of people are able to control axillary sweating with conventional antiperspirants, which typically contain aluminum chloride in a concentration of 1–2%. An additional percentage of patients are able to control their sweat-

ing with a concentrated 20% solution of aluminum chloride hexahydrate or similar aluminum salts. However, these chemicals can be irritating to the delicate armpit skin and require continuous usage.

Topical anticholinergics and tannic acids produce only mixed effectiveness and suffer from the same lack of permanence. Glutaraldehyde, occasionally employed for palmar and plantar hyperhidrosis, is too irritating for use in the axillae. Systemic anticholinergic therapy is usually limited by unwanted side effects such as dry mouth or dry eyes, drowsiness, and difficulty with urination. Iontophoresis is more effective on the palms or soles because they can be immersed in a water bath; the use, however, of saturated pads in the axillae has been described. Recently, injection with botulinum toxin has proven to be safe and effective for therapy of axillary hyperhidrosis.<sup>4</sup> However, at the present time, the need for repetitive injections, combined with high cost, has limited its widespread use.

### Surgical Therapy

For years, en bloc excision of the entirety of the central axilla was the mainstay of surgical therapy.<sup>5–8</sup> Although providing a cure for hyperhidrosis, this relatively crude method resulted in the certain morbidity of a large, long, unsightly red hypertrophic or wide, spread scar. Physicians then turned to methods that could be accomplished through small incisions. Eccrine and apocrine sweat glands have been attacked by surgeons wielding curettes or scissors attempting to separate the glands from their infundibula via blunt and sharp dissection. Unfortunately neither technique provided a means of subsequently removing the glands, allowing some to reattach and regenerate. Thoracic sympathectomy may be beneficial in some cases. However, this method requires an invasive surgical operation with permanent section of the respective nerves.<sup>9,10</sup> In addition, recurrence of hyperhidrosis after thoracic sympathectomy has been reported.<sup>11</sup>

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**Figure 1.** Materials needed for starch-iodine test: 3.5% iodine in alcohol and commercial cornstarch.

In an attempt to overcome these difficulties, attention was next turned to removal by liposuction. Lillis and Coleman<sup>12</sup> and others<sup>13-15</sup> have described successful methods employing this technique. I wish to further describe a means for identifying the location of the sweating and to provide details of a technique utilizing tumescent liposuction.

*Starch-Iodine Test*

Starch (a multicarbon polysaccharide) combined with elemental iodine (I<sub>2</sub>, brown) forms a blue-black precipitate in the presence of water. For testing properties, the best iodine source is a solution of 3.5% iodine in alcohol. This solution, made by a local pharmacy, is applied to the clean, dry, shaved axillae and allowed to air dry. Others have also written on the use of 1% povidone-iodine solution for this purpose.

Next, powdered cornstarch is lightly applied with a cotton ball to both axillae (Figures 1 and 2). In some cases, one may immediately perceive an immediate collection of small blue-black dots, each one representing the site of a sweat gland orifice. In other instances, the patient may need to be stimulated stressfully in order to produce sweat, especially if preoperative medications have been administered. This



**Figure 2.** Application of powdered cornstarch to axilla after iodine solution has dried in place.



**Figure 3.** Elicitation of sweating via sharp pinprick.

prompting may be accomplished by a hot light, a needle prick, or even the sight of a large-bore needle (Figure 3). The areas are then photographed for comparison to subsequent postoperative pictures.

In most cases, the axillary sweat glands are concentrated in a circular or ovoid area approximately 4-5 cm in diameter, although peripheral sweat glands should be noted as well (Figure 4). Next, a gentian violet marker is employed to delineate the entirety of the axillary sweating region, including a border of apparently uninvolved skin. Liposuction entry ports are marked simultaneously (Figure 5).

*Anesthesia*

Preoperative sedation is helpful for the anxious patient. The author commonly administers oral diazepam 10-15 mg, oral meclizine 50 mg, and oral hydrocodon 10-12.5 mg or oral oxycodone 1-2 tablets, 1 hour prior to the procedure for most tumescent liposculptures. However, sufficient anesthesia also may be obtained with intravenous midazolam, fentanyl, or diprovan, or intramuscular meperidine plus intramuscular prochlorperazine or hydroxyzine pamoate. Some patients may opt to have the surgery performed under local anesthesia alone.



**Figure 4.** Location of sweat glands is shown by area containing hundreds of confluent black dots.



**Figure 5.** Incision ports (small circles), with area to be treated with tumescent liposuction outlined by surgical marker. Sweat glands are visible as black area in the upper center of the axilla.



**Figure 7.** Utilization of small-gauge cannula to remove sweat glands via tumescent liposuction.

Both axillae are then prepped and draped in sterile fashion. Two to three small distant incision sites are selected at the periphery of the hyperhidrotic area to permit “crisscrossing” during liposuction. Local anesthesia is next administered via the “ice-saline-xylocaine technique.”<sup>19</sup> A small cryogel ice pack is applied for at least 10–15 seconds to take away the sting of the needle. Normal saline containing benzoyl alcohol (a weak local anesthetic as well as preservative) is then injected; this solution does not sting. Finally, a mixture of 1% xylocaine with epinephrine 1:100,000 mixed 50-50 with plain 0.5% bupivacaine hydrochloride is instilled at each incision site.

A tumescent solution, identical to that used for liposculpture, is prepared containing xylocaine 0.1%, epinephrine 1:1,000,000, with sodium bicarbonate 12.6 mg equivalence/L. This solution can be instilled with a pump utilizing a 14- or 16-gauge cannula with multiple orifices, or it can be injected with a syringe. It is important, however, to layer the tumescent solution as superficially as possible, creating a “peau d’orange” effect in the overlying tissue. The surgeon then waits 20–25 minutes for the local anesthesia and vasoconstriction to fully take effect.



**Figure 6.** Cannulas utilized for tumescent liposuction for axillary hyperhidrosis: left to right: Capistrano cannula, 12 gauge; fish-mouth cannula, 3 mm; and Klein Finesse cannula, 12 gauge.

### The Procedure

It is important to realize that the sweat glands lie in the most superior portion of the subcutaneous fat, right below the junction of the dermis and subcutaneous fat. Thus liposuction should be performed as superficially as possible. The 12-gauge Klein Finesse cannula (HK Medical, San Juan Capistrano, CA) is often selected as the initial instrument for body liposuction because of its tendency to “dive,” setting the initial tunnels at a deep plane just above the fascia (Figure 6). Conversely, when this cannula is rotated 180° so that the orifice faces up (ie, toward the dermis), it remains superficial.

Two or three sets of crisscrossed tunnels are first created by this method (Figure 7). A good second cannula selection is a 12-gauge Capistrano cannula (HK Medical). This cannula is crisscrossed aggressively in two to three directions, attempting to rasp the ports against the undersurface of the dermis and to remove loosened sweat glands through its side ports. A final pass is then made in all directions to all areas with a 3-mm fish-mouth, or similar cannula.



**Figure 8.** Liposuction is performed quite superficially with the orifice of the cannula turned upward toward the dermis. Note how easily visible the cannula orifice is through the dermis. Sweat glands lie at this depth.

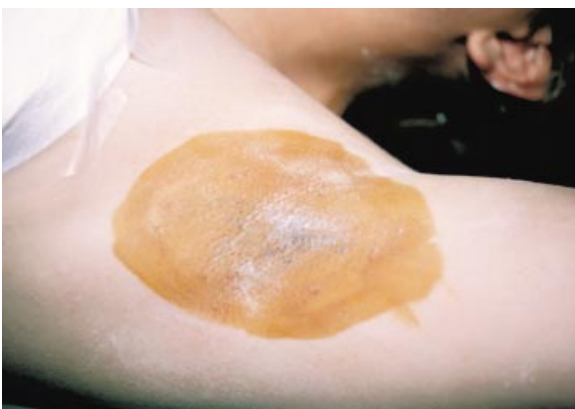


**Figure 9.** This patient, with bilateral axillary hyperhidrosis, had liposuction initially performed only in her left axilla. Note the absence of sweating in the left axilla 1 month after surgery, whereas sweating persists on the right side (untreated).

It should be emphasized that the goal is to remove sweat glands and not fat. If one stays in as superficial a plane as possible, a maximum number of glands can be removed while minimizing the risk to deeper axillary structures. Often at the conclusion of the procedure, one can easily visualize the cannula's orifice through a thinned dermis (Figure 8). The goal is to make as many tunnels in as many directions with as many cannulas as possible. However, in order to prevent the creation of a large "floating" section of dermis devoid of underlying vascular support, one should not attempt to create a single large pocket with a "windshield wiper" technique.

## Results

Axillary sweat gland removal via tumescent liposuction has uniformly produced considerable improvement in the patients' axillary hyperhidrosis. Although sweat volumes have not been collected, the adminis-



**Figure 10.** Starch-iodine test performed 1 month after tumescent liposuction shows nearly complete absence of sweating.



**Figure 11.** Starch-iodine test performed 1 month after subsequent liposuction in the right axilla reveals absence of sweating on this side as well.

tration of the starch-iodine technique 6 weeks postoperatively often demonstrates an 80–90% subjective and objective improvement (diminution) in sweating (Figures 9–12). However, some patients may then experience a rebound of sweating which gradually decreases over several months postoperatively. Some patients report that it takes up to 8 months after the liposuction to achieve the maximum possible benefit. This delay is presumably due to postoperative fibrosis which further damages the few remaining sweat glands.

Out of several dozen procedures, only one patient has requested a second liposuction procedure. This subsequent operation essentially eliminated his axillary sweating. It is impossible, of course, to eliminate all axillary sweat glands. However, a successful outcome is one where the patient can return to controlling his or her axillary sweating with conventional over-the-counter deodorants or antiperspirants.



**Figure 12.** The same patient as in Figure 9 now has an absence of sweating bilaterally after performance of liposuction in her right axilla.

Possible complications include bleeding, pain, hematoma, secondary infection, seroma, and damage to the axillary plexus or deeper structures. However, with the technique described above, the author has encountered no complications. Indeed, tumescent liposuction performed by dermatologists under local anesthesia has proven to be a safe and effective procedure over the long term.<sup>16-18</sup>

## Conclusion

Removal of axillary sweat glands via tumescent liposuction, properly performed, is a safe and effective technique. It is important to follow proper sterile surgical technique when performing this procedure. Dermatologists using this method should be accomplished with traditional body, face, and neck liposuction. This procedure can potentially benefit thousands of patients with disabling axillary hyperhidrosis resistant to conventional medical therapy.

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