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Prospective Open-Label Study of Botulinum Toxin Type A in Patients with Axillary Hyperhidrosis: Effects on Functional Impairment and Quality of Life

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BACKGROUND. Patients with primary axillary hyperhidrosis experience substantial functional impairment and reduced health-related quality of life (HRQOL). Few studies have comprehensively evaluated the effects of botulinum toxin type A (BoNT-A) on these symptoms.

OBJECTIVE. To prospectively assess the effects of BoNT-A on functional impairment associated with primary axillary hyperhidrosis.

METHODS. Patients treated with BoNT-A 50 U per axilla at baseline were assessed 4 and 12 weeks later. Outcome measures included functional impairment as assessed by the Hyperhidrosis Disease Severity Scale and the Hyperhidrosis Impact Questionnaire and dermatology-specific HRQOL as assessed by the Dermatology Life Quality Index.

RESULTS. At weeks 4 and 12 after BoNT-A treatment, 85% and 90% of patients achieved the a priori definition of treatment responder. Patients reported less occupational and emotional impairment, spent less time managing their hyperhidrosis, and had fewer difficulties in social situations. Adverse events were uncommon (5.5%), were mild, and did not require treatment. At study end, 53% of patients reported no dermatology-specific HRQOL impairment and 90% were satisfied with treatment.

CONCLUSIONS. Significant, meaningful, rapid, and durable reductions in disease severity and functional impairment, as well as improvements in HRQOL, were seen following BoNT-A treatment. BoNT-A was safe and well tolerated, producing high levels of patient satisfaction.

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PRIMARY AXILLARY hyperhidrosis is a chronic pathologic condition that is characterized by sweating in excess of that required to respond to environmental conditions. Although the exact cause is not known, it is thought to result from hyperstimulation of eccrine sweat glands by the cholinergic sympathetic fibers innervating them. Analysis of family histories suggests that hyperhidrosis is a hereditary disorder.[1] It is associated with significant occupational impairment, is frequently detrimental to physical and emotional well-being, and can result in difficulties in personal relationships and potential social stigmatization.[2–6] Historically, the prevalence of hyperhidrosis has been unclear. A recent rigorous household survey estimated that 2.8% of the population has hyperhidrosis, with roughly half of these individuals suffering from axillary hyperhidrosis. As many as 1.3 million individuals (0.5% of the US population) in this survey have been estimated to have severe axillary hyperhidrosis, defined as symptoms that frequently or always interfere with daily activities and that are intolerable or barely tolerable.[7]

First-line therapies for axillary hyperhidrosis (ie, topical aluminum chloride) are often short-acting, ineffective, or not well tolerated.[6,8] Surgical approaches, such as excision of the sweat glands and endoscopic transthoracic sympathectomy (ETS), are an option. However, surgical excision may lead to wound infection, slow healing, skin edge necrosis, hidradenitis (axillary abscesses), and reduced shoulder mobility owing to scarring. ETS is associated with failure, recurrence, high rates of compensatory sweating, extremely dry hands that may interfere with simple activities such as turning the pages of a book or counting money, and potentially serious side effects, such as wound infection, hemorrhage, pneumothorax, Horner's syndrome, cardiac effects, postsympathetic neuralgia, phrenic nerve damage, and even death.[8–13] In addition, although ETS is recognized as an effective treatment option for pal-

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mar hyperhidrosis, it is not generally recommended for axillary hyperhidrosis because of high recurrence and high rates of compensatory sweating.

Botulinum toxin type A (BoNT-A; BOTOX, Allergan, Inc, Irvine, CA, USA) has emerged as an important treatment option for hyperhidrosis. BoNT-A blocks the release of acetylcholine from peripheral cholinergic nerve terminals, effectively chemically denervating the sweat glands and consequently reducing sweat production. Placebo-controlled studies in Europe and the United States have demonstrated that BoNT-A is a safe and effective treatment for primary axillary hyperhidrosis.[3,14–16] A single BoNT-A treatment can provide relief from hyperhidrosis for at least 16 months,[3] with an average duration of effect of 6 to 7 months.[16]

Few studies, however, have comprehensively assessed the effects of BoNT-A on the functional impairment and reduced health-related quality of life (HRQOL) associated with primary axillary hyperhidrosis. These are key variables because effective treatment is ultimately a function of the patients' perceived impairment and quality of life. The objective of this study was to comprehensively assess the effects of BoNT-A treatment on functional impairment and HRQOL in a large sample of patients with primary axillary hyperhidrosis. In addition, this study uses a patient-reported outcomes measure, the Hyperhidrosis Disease Severity Scale (HDSS),[17] as the primary assessment of treatment efficacy. Published trials to date have used gravimetric measurement of sweat production as the primary efficacy measure.[14,15] Although this provides a quantitative measure of sweat production, gravimetric measurement has several limitations. First, gravimetric measurement is not practically or routinely used in clinical practice and is associated with high intrapatient variability over time.[2] Moreover, sweating may be totally absent in some patients at a given office visit even though it continues to pose a significant problem in daily functioning.[2] For this reason, when used in isolation, gravimetric measurement may not provide an accurate assessment of patient disability. Finally, there are no established population-based norms for sweating measured gravimetrically, making the values difficult to interpret. Thus, the use of the HDSS in the current study may reflect an advance in the evaluation of treatment responses.

Methods

Patient Population

Patients were at least 18 years old and had bilateral primary (idiopathic) axillary hyperhidrosis. To be included in the study, patients had to have severe hyperhidrosis characterized by a score of 3 or 4 on the HDSS (Table 1) and an unsatisfactory response to previous local or systemic drug therapy. Patients were excluded from the study if they had hyperhidrosis secondary to an underlying disease, an infection at the injection site, or any systemic infection, previous sympathectomy of any type, or surgical debulking of the sweat glands. Patients were also excluded if they had a diagnosis of any disease that might interfere with neuromuscular function (such as myasthenia gravis, Eaton-Lambert syndrome, or amyotrophic lateral sclerosis). Any female patient who was pregnant, breast-feeding, or of childbearing potential and not practicing a reliable method of birth control was excluded. Patients were not permitted to have been treated with botulinum toxin of any serotype for any reason or to have an expected need for botulinum toxin for any indication other than hyperhidrosis during the study. Concurrent use of agents that might interfere with neuromuscular function (eg, aminoglycoside antibiotics, curare-like agents) was not allowed. During the study period and for 7 days before the baseline visit, patients were not allowed to use cholinomimetic agents, anticholinergic agents, prescription antiperspirants or deodorants, any herbal medicines, or any other treatment for hyperhidrosis except over-the-counter antiperspirants or deodorants. Use of over-the-counter antiperspirants or deodorants was not permitted within 24 hours of the baseline visit. Patients could be withdrawn from the study if they had a serious adverse event, if they were unable physically or mentally to tolerate the test medication, if any exclusion criterion became apparent at any time during the study, or if they voluntarily withdrew.

Study Design

This was a multicenter (30 sites) prospective open-label study to assess changes in disease severity, functional impairment, and HRQOL in Canadian patients with primary axillary hyperhidrosis after treatment with BoNT-A. The study was of 12 weeks duration and consisted of a baseline visit (day 0) and follow-up visits at weeks 4 and 12. At the baseline visit, all patients were treated with intradermal BoNT-A 50 U per axilla.

The hyperhidrotic area of each axilla was determined by using the Minor iodine starch test. Each axilla was then

Table 1. Hyperhidrosis Disease Severity Scale

How would you rate the severity of your hyperhidrosis?	*Score*
My underarm sweating is never noticeable and never interferes with my daily activities.	1
My underarm sweating is tolerable but sometimes interferes with my daily activities.	2
My underarm sweating is barely tolerable and frequently interferes with my daily activities.	3
My underarm sweating is intolerable and always interferes with my daily activities.	4

injected intradermally at 10 to 15 sites that were evenly spaced and positioned in a staggered manner. The injection volume at each site was determined by dividing the total injection volume per axilla (2 mL) by the number of injection sites. Each patient was monitored for 30 minutes after the administration of BoNT-A for adverse events.

Patient recruitment was assisted by advertisements in newspapers and on the radio that were approved by the central Ethics Review Committee. Patients were screened by telephone on days −30 to −1 to obtain demographic data and eligibility for the study (based on primary inclusion and exclusion criteria). At the baseline visit, week 4, and week 12, each patient completed the HDSS, the Hyperhidrosis Impact Questionnaire (HHIQ), and the Dermatology Life Quality Index (DLQI).

Efficacy Evaluation

The primary efficacy measure was the change in disease severity from baseline to week 4, as indicated by the HDSS, a validated single-item 4-point scale on which patients rate the tolerability of their hyperhidrosis symptoms and the degree of interference with their daily activities that those symptoms cause (see Table 1).[17] A score of 4 indicates the least tolerability and greatest interference with daily activities. The a priori definition of a treatment responder was a patient who had a score of 1 or 2 on the HDSS after treatment, regardless of his or her score at baseline (3 or 4).

Secondary end points were safety and the change in functional impairment and HRQOL from baseline to week 4, as measured by the HHIQ and DLQI. The HHIQ, a validated instrument that quantifies the functional impairment associated with hyperhidrosis in occupational, physical, emotional, interpersonal, and social domains, consists of a 41-item baseline module and a 10-item follow-up module.[3,18] The DLQI is a validated 10-item questionnaire that assesses dermatology-specific HRQOL in six domains: symptoms and feelings, daily activities, leisure, work and school, personal relationships, and treatment.[19] The maximum score is 30, with 0 indicating the least impaired HRQOL and 30 the most impaired HRQOL. Patient satisfaction with treatment was measured by using the following single item on the HHIQ: *What is your level of satisfaction with your current treatment for hyperhidrosis?* The response options were very dissatisfied, somewhat dissatisfied, neutral, somewhat satisfied, and very satisfied.

Safety Evaluations

Patients were monitored throughout the study for signs and symptoms of adverse events. Patients were encouraged to report to the investigator any adverse events occurring between the scheduled follow-up visits.

Statistical Analyses

Efficacy and safety analyses were conducted on an intent-to-treat basis. Continuous data were summarized by using descriptive statistics, and categorical data were summarized in frequency tables. A Wilcoxon signed-rank test was performed by using the first visit (baseline, day 0) as a reference point. Safety analyses were performed in terms of the incidence and severity of adverse and/or unexpected events. An α level of .05 was considered statistically significant.

Results

Patients

One hundred forty-six patients with primary axillary hyperhidrosis were enrolled. Baseline characteristics are presented in Table 2. The mean age was 35 years, and 67% of the patients were women. Hyperhidrosis was severe at baseline, with the majority of patients (64%) scoring 4 on the HDSS (sweating is intolerable and always interferes with my daily activities). The mean age at the onset of hyperhidrosis was 19 years, and 43% of patients reported a family history of this condition. Of the intent-to-treat population, 129 patients (88%) completed the study, 15 were lost to follow-up, 1 withdrew because of financial difficulties, and 1 discontinued for unknown reasons.

Efficacy

Disease Severity

Four weeks after treatment, 85% (121 of 142) of patients were classified as treatment responders (ie, achieved a

Table 2. Patient and Disease Characteristics (*N* = 146)

Characteristic	n
Age, yr, mean (range)	35 (18–73)
Females, %	67
Ethnicity, %	
Caucasian	93
Black	2
Hispanic	2
Asian	1
Other	1
HDSS score, %	
Score of 3	36
Score of 4	64
Mean age at axillary hyperhidrosis onset, yr	19
Mean age when axillary hyperhidrosis began affecting patient's daily life or activities, yr	20
Patients with family history of axillary hyperhidrosis, %	43

HDSS = Hyperhidrosis Disease Severity Scale.

score of 1 or 2 on the HDSS). This response was maintained at week 12, with 90% (115 of 128) of assessable patients having a score of 1 or 2 on the HDSS (Figure 1A). At week 4, 59% of patients had complete resolution of their symptoms, as indicated by an HDSS score of 1 (Figure 1B). This improvement was maintained at week 12 (63%; 80 of 128).

Functional Impairment

Occupational Impairment

Patients reported more satisfaction and less limitation at work because of their hyperhidrosis at 4 weeks and 12 weeks after treatment than at baseline (Figure 2). At baseline, 79% (114 of 144) of patients reported feeling moderately, quite a bit, or extremely limited at work because of their hyperhidrosis symptoms, but only 8% (10 of 127) reported this degree of work limitation at week 12. The proportion of patients who reported that their hyperhidrosis caused them to accomplish less at work than they thought they should or to change their work habits some, most, or all of the time decreased from 34% (41 of 121) and 43% (53 of 122) at baseline, respectively, to 4% (4 of 105) and 7% (7 of 104) at week 12. Consistent with these data, their overall satisfaction with their ability to perform work activities owing to hyperhidrosis was low at baseline (8%; 10 of 126) and improved at week 12 in the majority of patients (87%; 104 of 119).

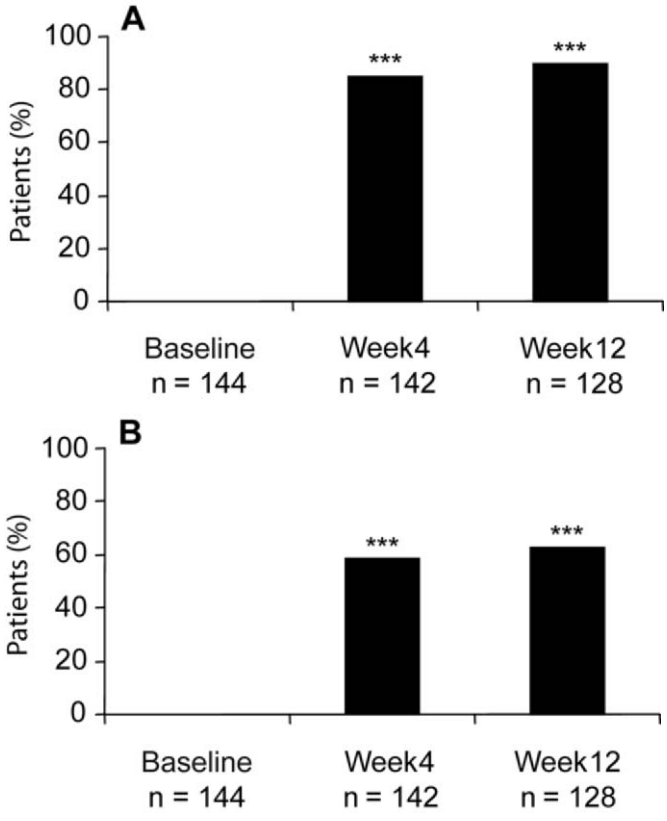

Figure 1. Severity of primary axillary hyperhidrosis at baseline and after treatment. (A) Treatment responders (patients achieving 1 or 2 on the Hyperhidrosis Disease Severity Scale [HDSS]); (B) patients achieving complete resolution of symptoms (score of 1 on the HDSS); ***$p < .001$ versus baseline.

Time Spent Managing Hyperhidrosis

Patients also reported spending less time and effort managing their hyperhidrosis after treatment. The proportion of patients who changed their clothing at least two times a day was 77% (112 of 145) at baseline, 25% (35 of 142) at week 4, and 13% (16 of 128) at week 12. At baseline, 30% (43 of 144) of patients spent from 15 to more than 60 minutes a day treating their hyperhidrosis; this decreased to 13% (18 of 142) and 10% (13 of 127) at week 4 and week 12, respectively.

Emotional Impairment

Patients' emotional well-being was also markedly affected by treatment with BoNT-A (Figure 3). At baseline, patients expressed a high degree of emotional impairment because of their hyperhidrosis. Sixty-seven percent (97 of 145) reported feeling moderately or significantly emotionally damaged or injured. In addition, at baseline, many patients reported feeling less confident than they would like because of their hyperhidrosis (94%; 133 of 142), unhappy or depressed (46%; 65 of 142), and frustrated with many daily activities (61%; 86 of 142). Treatment with BoNT-A resulted in significant improvements in this emotional impairment. Specifically, 4 weeks after treatment, fewer patients reported feeling emotionally damaged or injured (28%; 40 of 142), less confident (52%; 72 of 139), unhappy or depressed (24%; 33 of 139), and frustrated with daily activities (25%; 34 of 139). These values were similar at week 12.

Limitations in Personal Relationships and Social Situations

Patients' ability to function in personal relationships and social situations also improved significantly after BoNT-A treatment (Figure 4 and Table 3). At baseline, the majority of patients reported feeling moderately, quite a bit, or extremely limited in developing personal relationships (70%; 102 of 145), on family occasions or with friends (79%; 114 of 145), and in sexual activities (52%; 75 of 145). Four weeks after treatment, these limitations were present in 12% or fewer patients. This improvement was maintained at week 12. At baseline, substantial numbers of patients also reported moderate to extreme limitations in social situations such as being in public places (84%; 121 of 144), meeting people for the first time (90%; 130 of 145), and shaking hands (50%; 72 of 145). Significant improvement in functioning in these situations was reported 4 weeks after BoNT-A treatment, with fewer than 20% of patients reporting moderate to extreme limitations at this time point. These improvements were maintained at week 12. Consistent with these data, patient satisfaction

with nonwork activities increased from 6% (8 of 132) at baseline to 90% (122 of 136) at week 4. This effect was sustained at week 12: 85% (104 of 122) of patients were somewhat or very satisfied with their ability to perform nonwork activities.

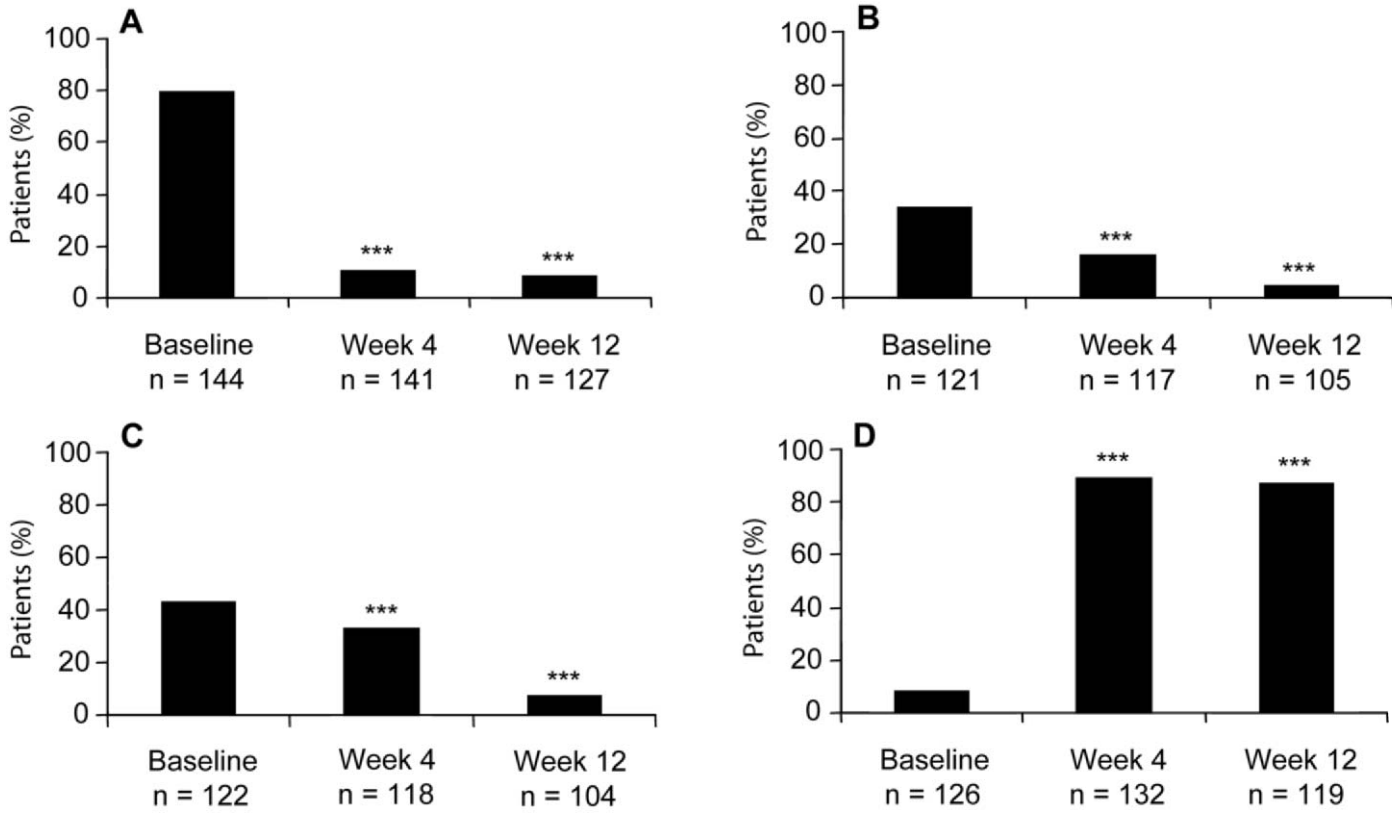

Figure 2. Occupational or productivity impairment at baseline and after treatment. (A) Patients who felt moderately to extremely limited at work owing to their hyperhidrosis. (B) Patients who felt that they accomplished less at work some, most, or all of the time because of their hyperhidrosis. (C) Patients who felt that their work habits were altered some, most, or all of the time because of hyperhidrosis. (D) Patients who were somewhat or very satisfied with their ability to perform work activities because of hyperhidrosis; ***$p < .001$ versus baseline. Questionnaire items and response options for each panel: (A) Item: *How limited do you feel you are at work owing to hyperhidrosis?* Response options: not limited, somewhat limited, moderately limited, quite a bit limited, or extremely limited. (B) Item: *Over the last 3 months, I feel I accomplished less work than I should because of my hyperhidrosis*. Response options: true none of the time, little of the time, some of the time, most of the time, all of the time. (C) *Over the last 3 months, I did my work but with some changes because of my hyperhidrosis.* Response options: true none of the time, little of the time, some of the time, most of the time, all of the time. (D) Item: *Please rate your overall level of satisfaction with your ability to perform current work activities due to hyperhidrosis*. Response options: very dissatisfied, somewhat dissatisfied, neutral, satisfied.

Table 3. Patient-Reported Effects of Hyperhidrosis on Ability to Function in Social Situations

Patient-Reported Outcome	*Baseline, %*	*Week 4, %*	*Week 12, %*
Satisfaction with current nonwork activities[†]	6	90***	85***
Feel moderately to extremely limited being in public places owing to hyperhidrosis[‡]	84	14***	11***
Feel moderately to extremely limited when meeting or being introduced to people due to hyperhidrosis[2‡]	90	19***	21***
Feel moderately to extremely limited shaking hands owing to hyperhidrosis[‡]	50	19***	21***

[†]Response options: very dissatisfied, somewhat dissatisfied, neutral, somewhat satisfied, very satisfied.

[‡]Response options: not limited, somewhat limited, moderately limited, quite limited, extremely limited.

***$p < .001$ versus placebo.

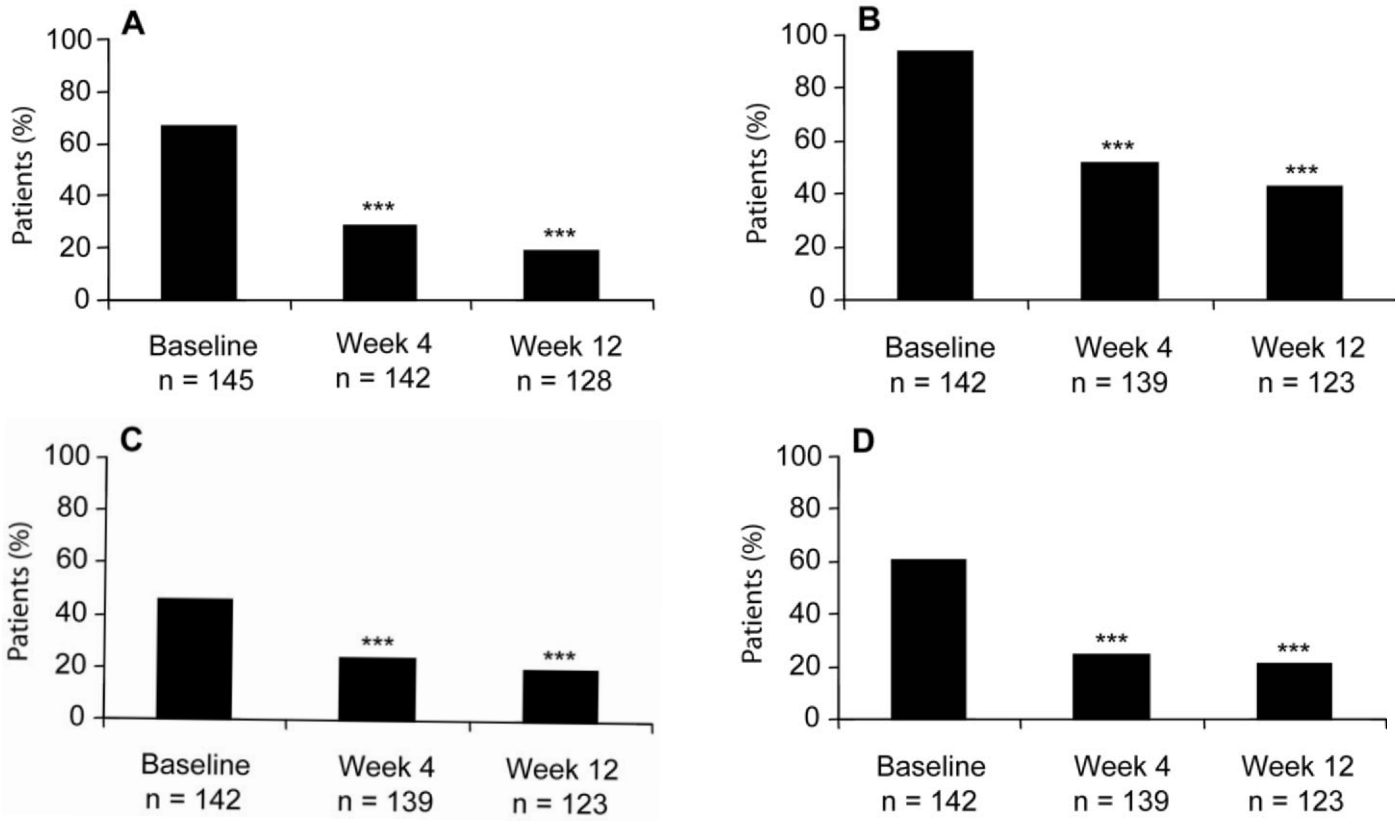

Figure 3. Emotional impairment at baseline and after treatment. (A) Patients who felt moderately or significantly emotionally damaged or injured because of hyperhidrosis; (B) patients who felt less confident than they would like because of hyperhidrosis; (C) patients who felt unhappy or depressed because of hyperhidrosis; (D) patients who felt frustrated with daily activities because of hyperhidrosis; ***$p < .001$ versus baseline. Questionnaire items and response options for each panel: (A) Item: *Do you feel emotionally damaged or injured because of hyperhidrosis?* Response options: not affected emotionally, affected emotionally to a small extent, affected emotionally moderately, or affected emotionally significantly. (B) Item: *Does hyperhidrosis make you feel less confident than you would like?* (C) Item: *Does hyperhidrosis make you feel unhappy or depressed?* (D) Item: *Does hyperhidrosis make you feel frustrated with daily activities?* Response options for B, C, and D: yes or no.

Dermatology-Specific HRQOL

Consistent with the marked functional impairment reported by patients at baseline, they also reported substantial impairment in dermatology-specific HRQOL at baseline, as indicated by a mean total DLQI score of 10.6. After BoNT-A treatment, the mean DLQI score improved to 1.7. In addition, the majority of patients achieved at least a 5-point reduction in DLQI score (the minimal clinically important difference[20]) at week 4 (72%; 101 of 141) and at week 12 (76%; 97 of 127). Finally, the majority of patients reported a complete resolution of dermatology-specific HRQOL impairment (DLQI score of 0) at week 4 (55%; 77 of 141) and at week 12 (53%; 67 of 127) (Figure 5).

Treatment Satisfaction

Consistent with the improvements reported in functional impairment and in HRQOL, the vast majority of patients reported satisfaction with BoNT-A treatment. Specifically, the proportion of patients who reported being somewhat or very satisfied with their current treatment for hyperhidrosis was 15% (14 of 96) at baseline, 93% (131 of 141) at week 4, and 90% (113 of 126) at week 12.

Safety

Treatment-related adverse events were observed in 5.5% (8 of 146) of patients. All adverse events with a probable or definite relationship to the study treatment were mild, and no patients required treatment. Two patients reported injection-site pain, and one patient reported feeling lightheaded after the injections. Three patients reported an increase in nonaxillary sweating (front of head, chest and neck, palms and feet), and two patients reported tenderness or pain on touching of the axillae.

Discussion

Treatment with BoNT-A produced significant, rapid, and durable reductions in disease severity and had minimal side effects. The majority of patients achieved complete

resolution of symptoms, defined as a score of 1 on the HDSS (Table 1, sweating is never noticeable and never interferes with my daily activities). Symptom reduction was sustained at the end of the 12-week study period after a single BoNT-A treatment. Treatment with BoNT-A also substantially reduced the marked functional impairment associated with hyperhidrosis and improved HRQOL. Significant improvements from baseline were observed in occupational functioning, time spent managing the condition, emotional well-being, and functioning in interpersonal relationships and social situations. Improvements were seen at the first follow-up visit and continued through the end of the study. These results confirm similar improvements in functioning as measured by the HHIQ and reported by Naumann and colleagues.[3]

Consistent with the high degree of functional impairment at baseline, patients also showed significant impairment in dermatology-specific HRQOL at baseline (mean DLQI score of 10.6). This score is comparable to those in patients with other serious dermatologic diseases and conditions, such as severe acne (9.2), pruritus (9.2 and 10.5), and psoriasis (8.9).[2] Similar to the findings in other studies in small groups of patients,[2,4,21] there were substantial improvements in the DLQI score after BoNT-A treatment. In addition, the vast majority of patients had at least a 5-point reduction in DLQI score (the minimal clinically important difference[20]) at each time point (72% at week 4, 76% at week 12), and a full 53% had no HRQOL impair-

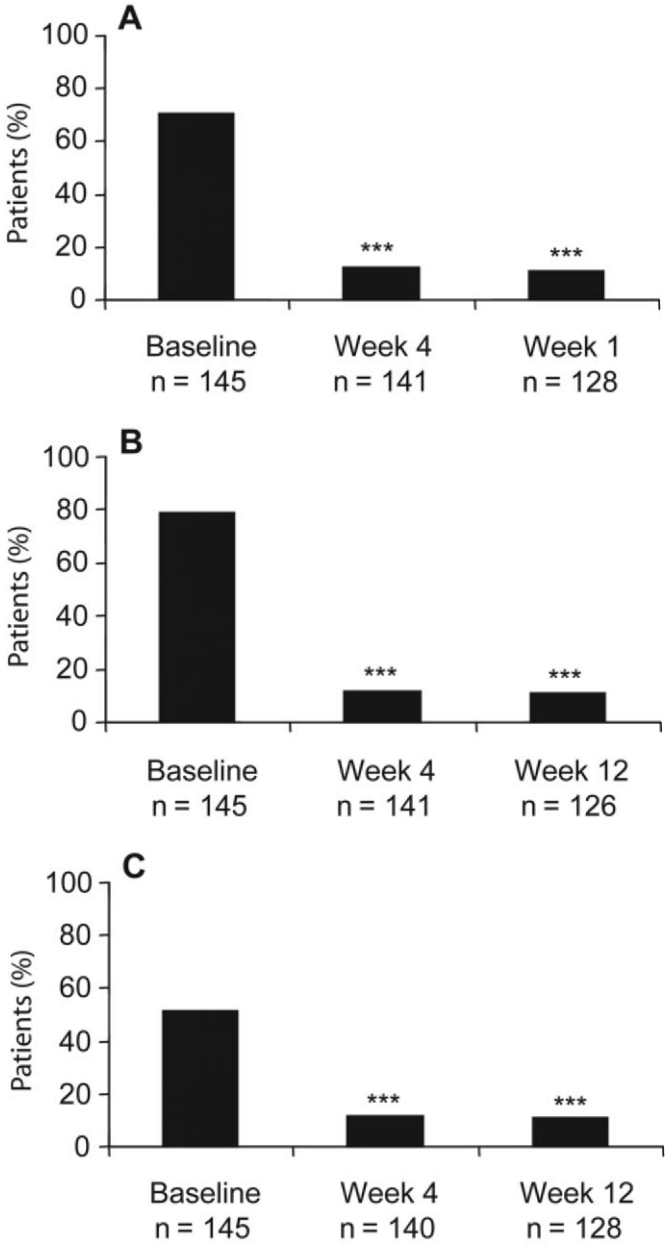

Figure 4. Difficulties in personal relationships at baseline and after treatment. (A) Patients who felt moderately to extremely limited in developing relationships owing to hyperhidrosis; (B) patients who felt moderately to extremely limited on family occasions or with friends; (C) patients who felt moderately to extremely limited in sexual activities because of hyperhidrosis; ***$p < .001$ versus baseline. Questionnaire items and response options for each panel: Item: *How limited do you feel you currently are in each of these activities/situations because of your hyperhidrosis?* (A) In developing personal relationships; (B) on family occasions or with friends; (C) in sexual activities. Response options: not limited, somewhat limited, moderately limited, quite a bit limited, or extremely limited.

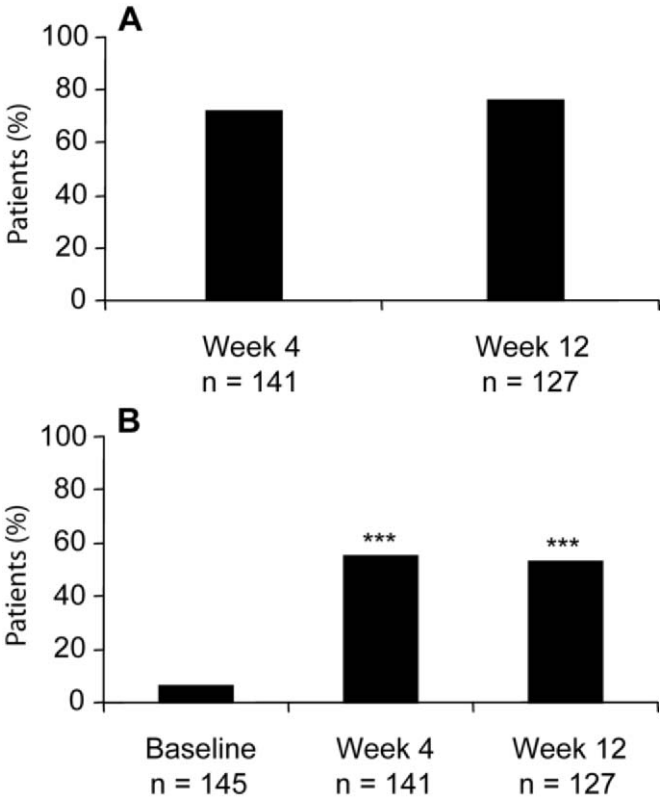

Figure 5. Effect of botulinum toxin type A treatment on dermatology-specific health-related quality of life (HRQOL). (A) Patients achieving at least a 5-point improvement in Dermatology Life Quality Improvement (DLQI) score; (B) patients with no decrements in dermatology-specific HRQOL (score of 0 on the DLQI); ***$p < .001$ versus baseline.

ment (ie, DLQI score of 0) at the end of the study. For comparison, in a study of treatment with etanercept 50 mg twice weekly in patients with moderate to severe psoriasis, approximately 70% of patients had a 5-point improvement in DLQI score and 24% reported a DLQI score of 0 at week 12.[22]

Improvements in disease severity in this trial confirm those in randomized placebo-controlled trials of BoNT-A 50 U per axilla in patients with bilateral primary axillary hyperhidrosis. In a European trial that used a gravimetric measure of efficacy (treatment response defined as ≥ 50% reduction from baseline in axillary sweating), 94% of patients responded to treatment at week 4 (vs 36% of patients in the placebo arm).[14] In a 52-week North American trial, 80% of patients treated with BTX-A compared with 21% of patients treated with placebo achieved > 75% reduction in sweating, measured gravimetrically.[16]

This is the first published study to use the HDSS as the primary efficacy measure. The HDSS has advantages over gravimetric measurement of sweat production (often used in clinical trials) in that it is easy to administer and quantifies the patient-perceived severity of symptoms and disability. Moreover, gravimetric measurement is associated with a high degree of intrapatient variability,[2] and data can be difficult to interpret because there are no established values to clearly distinguish patients with hyperhidrosis. For these reasons, gravimetric measurement is generally reserved for research purposes and is ideally used as part of an assessment package rather than as an isolated measure. An additional feature of the HDSS is that it can be used to quantify the impact of hyperhidrosis on daily activities, a key diagnostic criterion.[6]

There have been no treatment-related serious adverse events reported in clinical trials of BoNT-A for hyperhidrosis,[14–16] even after repeated treatments.[15,16] The side effects, if any, are typically mild and transient. Safety data from the current study confirmed these findings, with only 5.5% of patients reporting treatment-related adverse events, all of which were mild. Even the mild pain associated with injection reported by two patients could be further reduced because it may be related to reconstituting BoNT-A in saline without preservative. Reconstituting BoNT-A in saline with preservative can significantly reduce pain on injection.[23]

The excellent efficacy and safety and good tolerability of BoNT-A are reflected in consistently high levels of patient satisfaction. In a placebo-controlled trial of BoNT-A in patients with hyperhidrosis, patients' satisfaction with their current treatment markedly increased after treatment with BoNT-A (32% at baseline, 93% at week 16) but not with placebo (20% at baseline, 30% at week 16).[15] Moreover, the majority of patients in clinical trials have reported being more satisfied with BoNT-A treatment than with their previous treatments for hyperhidrosis.[3,16] Similar levels of treatment satisfaction were reported in this study, with 90% of patients satisfied at week 12.

The population of patients treated in this study is typical of patients with severe primary axillary hyperhidrosis. Patients in this study reported a mean age at onset of 19 years. In a recent large-scale survey of 150,000 households in the United States, persons with axillary hyperhidrosis had a mean age at onset of 22 years, and the condition persisted throughout their prime working years.[7] In addition, 43% of patients in this study reported a family history of axillary hyperhidrosis. A similar incidence of family history was reported in a large European trial (38%)[14] and in a small case series (37%).[1] This incidence of family history is consistent with autosomal dominant transmission.[1] A more comprehensive assessment of family history in patients with palmar, plantar, and axillary hyperhidrosis also showed evidence of genetic transmission of hyperhidrosis.[24] This study suggested that one or two copies of the hyperhidrosis allele would result in hyperhidrosis 25% of the time (ie, 25% penetrance).[24] Future research is necessary to characterize the potential genetically transmissible factors that underlie the pathophysiology of hyperhidrosis.

This study is limited by its open-label design and relatively short follow-up. However, many of the efficacy and safety results in this study are consistent with those in a 16-week, double-blind, randomized trial[2,14] and a year-long open-label extension of that trial,[15] as well as a year-long double-blind trial.[16] It should also be noted that the methods and results reported here are with the BOTOX formulation of BoNT-A and cannot be generalized to other formulations of BoNT-A or to other botulinum toxin serotypes.

In summary, this is the first published study to comprehensively assess the effect of BoNT-A treatment on functional impairment and HRQOL, as well as to use a patient-reported measure as the primary efficacy measure in a large population of patients with primary axillary hyperhidrosis. As such, this study provides new information about specific impairments in daily activities associated with hyperhidrosis and the effect of treatment with BoNT-A on these impairments. In addition to its clinical utility, this information may also be useful for patient and physician health care decision-making. Specifically, patients and physicians may find these data useful for initial assessments about the need for treatment and for monitoring improvements or declines in those areas of daily activities that are important to the patient. Monitoring the effect of hyperhidrosis on functioning in daily activities may also assist in alerting physicians to the need for retreatment.

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