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Management of Supraglottic Squeeze in Adductor Spasmodic Dysphonia: A New Technique

Nwanmegha Young, MD; Andrew Blitzer, MD, DDS

Objectives: Spasmodic dysphonia is a disabling disorder of the voice characterized primarily by involuntary disruptions of phonation. Botulinum toxin injections of the thyroarytenoid muscles have been the treatment of choice for adductor spasmodic dysphonia (ADSD). We describe a new technique to address the problem of compensatory or supraglottic hyperadduction in some of these patients.

Study Design: Case series.

Methods: Four patients with ADSD with sphincteric supraglottic contraction were seen for evaluation of botulinum toxin injection. On fiberoptic exam, it was noted that they had type I hyperadduction of the true vocal cords with a significant type III, and/or type IV hyperadduction of the supraglottis. After standard management of the thyroarytenoid muscles, the strained/strangled voice continued. On fiberoptic exam it was noted that the vocal folds were weakened, but the supraglottic hyperfunction persisted. The patients were treated by speech therapists to unload their supraglottis without success. All patients then had their oblique portion of the lateral cricoarytenoid muscles injected with botulinum toxin A through a thyrohyoid approach. This was done in the office under electromyographic control.

Results: On follow-up, all patients demonstrated improvement in the quality of their voices (as compared to thyroarytenoid injections alone).

Conclusions: We describe a new technique for injection of the supraglottic portion of the lateral cricoarytenoid muscles. We demonstrate this can be done safely and successfully in an office setting with electromyography control.

Key Words: Botulinum toxin, spasmodic dysphonia, hyperadduction, thyrohyoid.

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From the New York Center for Voice and Swallowing, Columbia University, New York, NY, U.S.A.

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Send correspondence to: Nwanmegha Young, MD, New York Center for Voice and Swallowing, 425 West 59th Street 10th Floor New York, NY 10019, U.S.A. E-mail: meghayoung@aol.com

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INTRODUCTION

Spasmodic dysphonia (SD) is a central motor processing disorder that causes action-induced spasms of the laryngeal muscles.[1] It is a chronic disorder that can be very debilitating to the affected and for which there is no cure. Botulinum toxin combined with speech therapy is the most effective treatment for managing this disorder.[2] For adductor spasmodic dysphonia (ADSD), injections of botulinum toxin are typically given into the thyroarytenoid (TA) muscles. The TA muscles are approached transorally or through the cricothyroid membrane. Both of these methods inject toxin at the level of the glottis. Fiberoptic examination of patients with ADSD occasionally demonstrates hyperadduction at the level of the supraglottis as well. This supraglottic hyperadduction usually resolves after speech therapy. In some patients, the dystonic dysfunction is manifested as hyperfunction of the aryepiglottitis muscle, the lateral cricoarytenoid muscle, and the oblique fibers of the thyroarytenoid muscle. Management of persistent supraglottic hyperadduction can be problematic. We present four patients with ADSD and supraglottic hyperadduction who after traditional treatment had their supraglottic musculature injected by a thyrohyoid approach.

METHODS

Four patients with ADSD with accompanying supraglottic hyperadduction are presented. Their supraglottic hyperadduction was fiberoptically observed during connecting speech and classified based on a modification of a scale developed by Koufman[3] (Table I). All patients were also given a self-assessment rating scale. This scale was ranged from 0 to 100, with 0 representing the worst possible voice and 100 the patient's best possible voice. Both pre- and post-injection assessments were obtained. During the procedure the patients were placed in the recumbent position. This supraglottic injection was performed with electromyography (EMG) and fiberoptic guidance. Ground and reference leads were placed on the skin and connected to the EMG machine. The skin of the neck was cleaned with alcohol. A hollow 27-gauge, Teflon coated, monopolar EMG needle was placed on a 1-mL tuberculin syringe. The needle was then placed through the neck skin and thyrohyoid membrane, just above the thyroid notch. The needle was

TABLE I.
Classification of Hyperadduction.

Type	Characteristic
Type I hyperadduction	At the level of the vocal cords where the arytenoids are compressed
Type II hyperadduction	The false cords contract
Type III hyperadduction	The arytenoids make contact with the petiole of the epiglottis
Type IV hyperadduction	Sphincteric closure

then angled slightly inferior and laterally, through the preepiglottic space and into the supraglottic muscle complex with fiberoptic visualization. Proper placement was confirmed by electrical signal. Between 2.5 to 5 units of botulinum toxin A and 250 to 500 units of toxin B were injected.

Case A

A 62-year-old married woman was diagnosed with Meige's syndrome, which manifested as spasmodic dysphonia and blepharospasm in 1989. She initially underwent extensive speech therapy and received botulinum toxin injections into her thyroarytenoid muscles. At first, she had good benefit with a much clearer voice. However, over time she began to have less benefit from the combined therapy, even with increasing dosages of botulinum toxin. She was switched to botulinum toxin B, which gave her some improvement but which was also suboptimal. Her phonatory characteristics revealed a strained, strangled voice. Fiberoptic exam revealed type IV hyperadduction ("sphincteric") with intermittent tight supraglottic squeeze.

Case B

A 54-year-old man developed speech difficulty in 1985 after being hit by a car. Over the next few years his speech deteriorated. He began speech therapy with mild improvement of his symptoms. He further deteriorated, and was finally diagnosed with ADSD 4 years later. Combined therapy was initiated with improvement of symptoms. Treatment continued for several years with good control of his symptoms. However, he began to develop dystonia in his jaw muscles and neck. His speech became nearly incomprehensible, despite increasing dosages of botulinum toxin. Fiberoptic exam revealed type IV hyperadduction with sphincteric closure of the glottis and supraglottis.

Case C

A 59-year-old woman had a slow onset of hoarse voice. She was told she had polyps on her vocal cords. In August of 1995, she underwent a polypectomy performed by her local physician, but her voice continued to get tighter and more effortful. She was seen in the office in April of 1996 and was diagnosed with ADSD. The patient began treatment with an excellent response to combined therapy. She remained stable for several years, and then began to have increasing difficulty of her voice. Fiberoptic exam revealed type II hyperadduction of the false vocal cords.

Case D

A 49-year-old woman was seen for evaluation of speech difficulty. She dates the onset of strained, strangled, and low volume voice to approximately January 2000. Her voice became worse over the following 6 months, and she was diagnosed with spasmodic dysphonia in June 2000. She underwent multiple botulinum toxin along with speech therapy with significant improvement of her voice for two and a half years. However, since 2004, she reports only breathiness after botulinum toxin injections and minimal improvement. Fiberoptic exam demonstrated weak thyroarytenoid muscles and type III hyperadduction

RESULTS

All four patients pre- and postinjection self-assessment were analyzed (Table II). Patients B and D experienced mild to moderate dysphagia after their first injections. This resolved over 1 to 2 weeks.

DISCUSSION

The problem of supraglottic hyperadduction is seen in a variety of vocal disorders including Parkinson's disease and spasmodic dysphonia.[4,5] This may be part of a compensating strategy of trying to force sound out of the glottis. More unusual is a true dystonia involving the muscles of the supraglottis. The laryngeal musculature that contributes to supraglottic squeeze includes oblique fibers of TA, the lateral cricoarytenoid and aryepiglottis muscles. Most patients can have their supraglottis "unloaded" with intensive speech therapy, however some patients continue to have supraglottic squeeze despite combined therapy. The thyrohyoid approach for vocal cord augmentation has been described.[6] This is the first report of a technique for treating supraglottic squeeze by injecting botulinum toxin into the supraglottic muscle complex via the thyrohyoid approach.

CONCLUSION

Supraglottic squeeze is seen in about 25% of patients with ADSD. It is usually resolved with speech therapy or injections of botulinum toxin in the thyroarytenoid muscles, or a combination of the two. Patients that fail this traditional therapy can be managed safely and effectively

TABLE II.
Analysis of Treatment.

Patient	Number of Injections	Preinjection Rating	Postinjection Rating	Average Toxin Dose	Type of Toxin
A	2	35 ± 0	57.5 ± 3.5	375	B
B	4	21.3 ± 2.5	52.5 ± 4.8	4.4	A
C	4	17.5 ± 6.5	43.8 ± 2.5	2.5	A
D	3	26.7 ± 2.9	53.3 ± 2.9	3.3	A

in the office setting with injections of botulinum toxin in the supraglottic musculature.

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