The need to tic

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Botulinum toxin (BoNT) injections are commonly used to treat focal motor and vocal tics. However, rigorous studies on BoNT efficacy and tolerability in this field are lacking[1]. In our experience, BoNT is effective and well-tolerated in the treatment of tics, and the discontinuation rate due to inefficacy is very low. Importantly, the mechanism of BoNT-related tic improvement remains unclear. Kwak et al. suggested that BoNT injections might lead to a reduction in both the intensity of premonitory urges and tics in patients with Tourette Syndrome (TS), as noted in 21/25 of their cases[2]. In contrast to this observation, here we report three patients with TS who decided to discontinue BoNT because the resulting muscle paralysis prevented tic occurrence and the subsequent relief of their premonitory urges.

Patient 1 is a 27-year-old female presenting with simple and complex motor tics as well as a history of simple vocal tics (coughing, sniffing). The current phenomenology includes head jerks and eye movements to the left, eye winking, eyebrow raising, frowning, and pushing the tongue up in her mouth. She also reported to have an obsessive personality with superstitious beliefs. We treated her with BoNT injections only once, delivering a total dose of 60 U of AboBoNT/A to the Frontalis, the Corrugator and the Orbicularis Oculi muscles bilaterally.
Patient 2 is a 43-year-old male with simple motor tics involving his neck (side-to-side head jerks) and shoulder since early childhood and occasional vocal tics (coughing). He describes himself as a perfectionist but denies obsessive-compulsive features. He was treated once with a total dose of AboBoNT/A 100 U, 50 U in each Splenius Capitis.
Patient 3 is a 25-year old female who shows simple (e.g., eyebrow movements, eye rolling) and complex (e.g., stomping legs on the floor) motor tics, and simple phonic tics (e.g., repetitive coughing). She received BoNT injections only once in both Orbicularis Oculi and Frontalis muscles, for a total dose of 36 MU of IncoBoNT/A.
Although BoNT led to a substantial improvement of the targeted tics in all three patients, they declined to pursue BoNT treatment due to increased salience of premonitory urges. They felt frustrated for still experiencing the need to tic in the treated areas, without being able to do so due to BoNT-induced muscle weakness.

The pathophysiology of sensory symptoms associated with tic disorders is poorly understood. The negative reinforcement hypothesis views tics as operant behaviors to alleviate the aversive experience of premonitory urges[3]. BoNT prevents tics by inducing a certain degree of paralysis in the injected muscles. It might also play a role in disrupting the impaired sensory feedback in tic disorders, therefore reducing the intensity of premonitory sensations, as previously reported[2]. However, not all patients may share this improvement, and indeed the only randomized control study previously performed to assess BoNT efficacy for treating tics in primary tic disorders also documented a case where there was an increase of premonitory urges, despite the reduction of motor tics[4]. Of note, a similar dissociation between tic improvement and persistence of aversive somatic experiences ("sense of inner tension") was also previously reported in an adult who was treated with bilateral deep brain stimulation of the internal *globus pallidus*[5]. Taken together, our cases highlight the substantial heterogeneity of tic disorders, particularly with regard to treatment response, and characteristically illustrate that in some patients we can successfully treat the tic, but not the need to tic.

Author Roles

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(2) Statistical Analysis: A. Design, B. Execution, C. Review and Critique;

(3) Manuscript Preparation: A. Writing of the First Draft, B. Review and Critique.

GDL: 1B,1C, 3A

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