Local Injection of Botulinum Toxin Type A for Hemifacial Spasm

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Abstract

The preliminary experience of botulinum toxin treatment for hemifacial spasm is reported in this study. Five patients were treated with 10 injections of botulinum toxin in total. Botulinum toxin had a good to excellent effect in all cases. Improvement was observed 2 weeks to 1 month after the injection. The duration of improvement was 0–9 months (mean 4.2 months). The peak rank tended to decrease and the duration of improvement increased after several treatments. Hemifacial spasm caused by the anterior inferior cerebellar artery tended to subside easily. In contrast, compression by the vertebral artery was more refractory. Continuous facial spasm caused by operative trauma subsided after the injection, but paroxysmal spasm still occurred when eating or laughing. Spasm caused by trauma disappeared 4.5 months after the injection. The complications, which were facial nerve paresis in two cases (3 injections, 30%) and diplopia in one case (1 injection, 10%), were transient and subsided in 2 weeks.

Key words: botulinum toxin, hemifacial spasm, neurovascular decompression, trauma, vestibular schwannoma, aberrant regeneration

Introduction

Hemifacial spasm, a life-long condition characterized by involuntary unilateral contractions of the facial muscles, is a disabling disorder often resulting in mental irritation and social embarrassment. The lower eyelid is the most common site of initial involvement followed by the cheek and perioral region. Hemifacial spasm caused by neurovascular compression of the facial nerve at the root exit zone can often be cured by microvascular decompression of the facial nerve. Recurrence after operation or hemifacial spasm caused by trauma or unresectable tumor can be treated with baclofen or anticonvulsant agents. However, medical treatment is limited by side effects or low efficacy.2,6

Botulinum toxin is now available for hemifacial spasm treatment in Japan. This study reports our preliminary experience of botulinum toxin treatment in patients with hemifacial spasm.

Materials and Methods

Five patients were treated with 10 injections of botulinum toxin in total (Table 1). The four women and one man were aged 37–71 years (mean 58.2 years). All patients had had unilateral asynchronous facial contractions for 13 months to 17 years (mean 8 years 3 months).

Three patients had hemifacial spasm caused by vascular compression. The offending vessel was the anterior inferior cerebellar artery (AICA) in Case 1, but surgery was excluded because of contralateral deafness. Microvascular decompression of the facial nerve was performed for the AICA in Case 2 and the vertebral artery in Case 3, but hemifacial spasm recurred after operation in both patients.

Hemifacial spasm occurred after operative removal of an acoustic schwannoma and mild facial nerve paresis in Case 4. Case 5 had a prior history of facial nerve injury caused by traffic accident. Aberrant regeneration of facial nerve after the traumatic insult was probably the cause of the hemifacial spasm in these two patients. Surgery was not indicated in these cases.

Botulinum toxin type A (Allergan Co. Ltd., Irvine, Calif., U.S.A.) was diluted to a final concentration of 1.25 U/100 μl for therapeutic use and the dose was 1.25 U in a single bolus. Botulinum toxin of a total dose of 6.25–13.75 U (mean 9.6 U) was injected in 5–11 sites (mean 7.7 sites). Botulinum toxin was in-
Table 1 Summary of cases

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Age/ Sex</th>
<th>Cause of facial spasm</th>
<th>Previous treatment</th>
<th>Botulinum toxin treatment</th>
<th>Result of treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Amount (U)</td>
<td>Injection site</td>
</tr>
<tr>
<td>1</td>
<td>71/F</td>
<td>vascular</td>
<td>conservative</td>
<td>1st 8.75</td>
<td>periorculus</td>
</tr>
<tr>
<td></td>
<td></td>
<td>compression (AICA)</td>
<td></td>
<td>2nd 11.25</td>
<td>periorculus, orifice</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3rd 11.25</td>
<td>periorculus, orifice</td>
</tr>
<tr>
<td>2</td>
<td>70/M</td>
<td>vascular</td>
<td>neurovascular</td>
<td>1st 7.5</td>
<td>periorculus</td>
</tr>
<tr>
<td></td>
<td></td>
<td>compression (AICA)</td>
<td>decompression</td>
<td>2nd 13.75</td>
<td>periorculus, orifice</td>
</tr>
<tr>
<td>3</td>
<td>58/F</td>
<td>vascular</td>
<td>neurovascular</td>
<td>1st 10</td>
<td>periorculus, orifice</td>
</tr>
<tr>
<td></td>
<td></td>
<td>compression (AICA)</td>
<td>decompression</td>
<td>2nd 10</td>
<td>periorculus, orifice</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3rd 10</td>
<td>periorculus, orifice</td>
</tr>
<tr>
<td>4</td>
<td>55/F</td>
<td>acoustic</td>
<td>schwannoma</td>
<td>1st 7.5</td>
<td>periorculus</td>
</tr>
<tr>
<td>5</td>
<td>37/F</td>
<td>trauma</td>
<td>conservative</td>
<td>1st 6.25</td>
<td>periorculus</td>
</tr>
</tbody>
</table>

AICA: anterior inferior cerebellar artery, VA: vertebral artery.

Botulinum toxin had a good to excellent effect in all cases. Clinical improvement was observed 2 weeks to one month after the injection. The duration of improvement lasted for 3–9 months (mean 4.2 months) and the improvement was significant for 1–3 months after the injection (Fig. 1). One rank improvement in symptoms was obtained after five injections and lasted for 3–6 months (mean 4.1 months) (Fig. 2). Two rank improvement was obtained after four injections and lasted for 1–4 months (mean 1.8 months) before deteriorating to one rank improvement which lasted for 2–5 months (mean 3.6 months). The peak rank tended to decrease and the duration of improvement increased after several treatments.

Hemifacial spasm caused by the AICA (Cases 1 and 2) tended to subside easily after the injection. The peak rank decreased and the duration of improvement increased. In contrast, hemifacial spasm caused by compression of the vertebral artery (Case 3) was more refractory. Continuous facial spasm caused by surgery (Case 4) subsided after the injection, but paroxysmal spasm still occurred when eating or laughing. Spasm due to trauma (Case 5) disappeared 4.5 months after the injection.

The complications were slight facial nerve paresis in Cases 3 and 4 (3 injections, 30%) and minimum diplopia in Case 1 (1 injection, 10%), but were transient and subsided after 2 weeks (Table 1).
Discussion

Botulinum toxin derived from Clostridium botulinum binds to the motor nerve axon terminal through its heavy chain and is incorporated into the nerve cell by endocytosis. The light chain which is discharged from the endosome into the cytoplasm cuts the SNAP-25 which is engaged in the exocytosis of acetylcholine. Consequently, botulinum toxin blocks the release of acetylcholine from nerve terminals and causes functional denervation lasting up to 6 months. Botulinum toxin has types A to G, of which type A has the most effective and stable effect.

Recently, the efficacy of botulinum toxin, a functional denervation agent, has been demonstrated in several neurological diseases including blepharospasm, dystonia, spasmodic torticollis, dysphonia, spasticity, tremor, and tic.3) Recently, botulinum toxin has been used for the treatment of neurosurgical diseases such as hemifacial spasm with a 97% response rate.

Hemifacial spasm caused by vascular compression can be treated by microvascular decompression, but botulinum toxin is helpful in patients whose contralateral hearing ability is disturbed. Botulinum toxin is also useful for treating recurrence after surgery. Spasm caused by compression of the elongated vertebral artery was difficult to treat because the compression force was strong. However, botulinum toxin injection is recommended because the effect continued for 3 or 4 months and the patient could enjoy an improved quality of life.

Hemifacial spasm caused by facial nerve injury and intracranial tumor cannot be effectively treated by decompression but responds to botulinum toxin treatment.5,7) Botulinum toxin is the treatment of choice in cases of facial synkinesis and hyperlacrimation caused by aberrant regeneration of facial nerve paresis following trauma or tumor resection.2) Our case caused by trauma was cured, whereas the case caused by operative trauma showed persistent paroxysmal spasm even after the continuous hemifacial spasm subsided after the injection. This type of facial spasm is apparently rather difficult to treat.

Botulinum toxin treatment has several problems. Botulinum toxin causes temporary and reversible denervation, so the hemifacial spasm can recur. Such recurrence is related to the formation of nerve sprouts and the increase of collateral branches on the neural endplate of the facial muscle.1) The mean duration of improvement was reported to be 3.4 months, and repeated assessment showed no significant variation of peak and duration of improvement over the 1st to the 12th treatments.4) However, our cases showed that the peak rank tended to decrease and the duration of improvement increased (mean 4.2 months) after several treatments for recurrence.

Botulinum toxin is a local chemical denervator and its effect should be limited to the area of administration. However, complications such as ptosis and diplopia can happen if botulinum toxin spreads into the levator palpebral muscle and extraocular muscle.4) About 10 U of botulinum toxin are required for the effective treatment of hemifacial spasm without facial nerve paresis.8) However, a smaller dosage than 10 U can cause transient facial nerve paresis. Facial nerve paresis and diplopia oc-
curred in 30% and 10% of our cases, respectively. These complication rates seemed to be relatively higher than those reported, such as ptosis in 9.68% of cases, but the botulinum toxin effect was nondestrucrive and the complication was transient.6)

In conclusion, botulinum toxin is helpful in high risk cases with contralateral hearing ability disturbance or in recurrent cases after operation. Averrant regeneration of facial nerve paresis following the trauma is suspected to cause hemifacial spasm in cases of operative and accidental trauma. Botulinum toxin treatment also benefits these patients.

References


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Commentary

The gold standard in the management of hemifacial spasm is microvascular decompression. However, the procedure is not 100% effective, with some morbidity and rare mortality. Other procedures of choice for facial spasm are local nerve block at the stylomastoid foramen with mechanical compression or radiofre-quency coagulation (Hori T, et al. J Neurosurg 1981). Now this local block can be replaced by local injection of botulinum toxin type A. In this paper, various types of facial spasm, not only hemifacial spasm but also posttraumatic facial spasm, were treated by local injection of botulinum toxin type A with long-term follow up. These data are useful information to neurosurgeons who want to treat facial spasm of various etiology, despite including only a few cases. Recently, I personally have received a special license to treat facial spasm by botulinum toxin.

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Over the past decade, botulinum toxin (BT) therapy has assumed an important place in the armamentarium for treating focalized dystonic or spastic diseases. As regards idiopathic hemifacial spasm (HFS), for many neurologists in Europe, repeated BT injections constitute the first step of the treatment, although a palliative one. As a neurosurgeon dealing with the microsurgical treatment of the disease (we have treated 150 patients with a cure rate of 85% and no mortality or severe morbidity), we agree with the authors of this article that BT should be reserved only for cases in which surgical decompression of the facial nerve is impossible or cases of failed microvascular decompression (MVD). However, before indicating BT after “so-called unsuccessful” MVD, we recommend to wait as long as one year after surgery. As a matter of fact, in 34% of our cured patients, we noticed that the spasm was delayed for as much as a few months to one year in most of those patients. In two cases with severely atrophic nerve at its root exit zone, as observed at surgery, the delay was 3 years and a half! Besides HFS due to neuro-vascular conflicts, in whom we prefer to use MVD, that is in non-idiopathic facial spasmodic disorders, we consider BT therapy, like the authors of this article, the method of choice.

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Hemifacial spasm (HFS) is a common movement dis-order characterized by spasms of the muscles inner-vated by the VIIth cranial nerve. HFS causes obvious social embarrassment and disability. Most patients with this disorder have no obvious cause for their HFS (ref. 7 of this article). Some HFS patients have a causative structural lesion, usually a vascular loop compressing the facial nerve at the root exit zone. Other unusual causes for HFS include multiple sclerosis,
Botulinum toxin injections into the facial muscles has emerged as the treatment of choice for the majority of patients with HFS. Botulinum toxins temporarily inactivate the “docking proteins” which are critical to the fusion of acetylcholine containing vesicle with the presynaptic membrane at the neuromuscular junction. This results in interruption of neuromuscular transmission and suppression of spasms in the facial muscles. Several clinical studies have shown that repeated injections of botulinum toxin type A into facial muscles are safe and effective to significantly ameliorate symptoms of HFS (ref. 7)..Botulinum toxin injections are titratable, well tolerated and effective for 3–6 months in most patients with minimal side effects. Common side effects of botulinum toxin injections for HFS are transient pain at the injection site, subcutaneous hemorrhage particularly in the upper lid, transient ptosis and transient flattening of the nasolabial fold resulting in an asymmetric smile.

Oyama et al. report their interesting experience with botulinum toxin injections in HFS. This modality of treatment has recently become available in Japan and the authors have chosen HFS patients secondary to vascular compression or trauma to explore the usefulness of botulinum toxin therapy. The authors report ‘good to excellent’ results in most patients with a duration of effect of 0–9 months and conclude that botulinum toxin therapy may be an effective therapy for secondary HFS in high surgical risk patients. The authors further report that HFS secondary to vertebral artery compression may be more difficult to control with botulinum toxin therapy. The dosages of botulinum toxin used by Oyama et al. are lower than those typically used in HFS in the USA. This could potentially explain the variability in their results. Our experience and the literature suggest that relatively higher doses of carefully titrated botulinum toxin therapy for HFS provide excellent relief of symptoms of HFS for 3–6 months in most patients. Complications like diplopia can be avoided by careful needle placement in the facial subcutaneous plane. Inadvertent injections into the levator palpebrae superioris (which causes ptosis) can be avoided by directing the injections away from the muscle belly in the middle of the upper lid. Complications are further diminished if injection volumes in the upper lid are kept to <0.04 ml (4–5 units of botulinum toxin). Avoiding needle contact with tarsal veins can minimize subcutaneous hemorrhages. Injections into the nasolabial fold and orbicularis oris must be carefully titrated to avoid asymmetric smile. HFS refractory to botulinum toxin A injections may be effectively treated with botulinum toxin B injections or microvascular decompression surgery.

References


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