Botulinum Toxin Injection Technique for Treatment of Headaches

Botulinum toxin therapy may be considered for chronic daily headache when standard pharmacology is ineffective or results in adverse effects. Clinical observations and research suggest that botulinum toxin serotype A (BTX-A) may hold promise for pain treatment and headache prophylaxis by acting at the neuromuscular junction and through several antinociceptive mechanisms. This article introduces basic concepts that define headaches in the migraine continuum and provides an overview of BTX-A treatment. (Aesthetic Surg J 2002;22:65-68.)

In 1988, the International Headache Society (IHS) developed a standard classification for headaches,1 defining migraine as a headache with at least moderate intensity that is frequently unilateral, throbbing, or exacerbated by physical activity, and usually accompanied by nausea, photophobia, and phonophobia. Tension-type headaches (TTH) were characterized as a bandlike tightness without migraine-associated symptoms. Both headache types can evolve from episodic to almost daily occurrence (more than 180 d/y), leading some experts to propose that “chronic daily headache” (CDH) be included in the IHS classification.2 Pain in the craniofacial, pericranial, and cervical musculature resulting from macrotrauma or cumulative microtrauma can actuate a refractory CDH pattern that may respond to a new headache treatment, botulinum toxin (BTX).3

Migraine treatments are described as prophylactic, symptomatic, or abortive. Prophylactic therapies are applicable when migraine frequency is ≥2/wk. BTX therapy is appropriate to consider for CDH when standard pharmacology is ineffective or fraught with adverse side effects. Also, BTX prophylaxis is an enticing alternative to some standard preventive medications that interfere with alertness or cognitive efficiency in people who provide intellectual services or who operate vehicular machinery, such as aircraft or industrial equipment. Therapeutic benefits may result from elimination of localized myalgia, muscular triggers, or painful muscle tension that occurs during a headache; however, BTX central nervous system antinociceptive effects, currently under investigation, may prove to be more salient.4

When treating chronic migraine headaches, which I believe exist along a pathophysiologic continuum with TTH and CDH, I target craniofacial and cervical musculotendinous sites that act as migraine triggers or as pain generators during the headache. Palpation of these actively involved muscles may reveal spasm and tenderness or increased firmness. Therapeutic BTX dosages and injection techniques vary with the patient and with clinical disorders that may affect the same muscle groups, for example, hemifacial spasm, dystonia, and cosmetically undesirable hyperkinetic facial lines. Standardized criteria for BTX headache treatment have not yet been established. Some advocate lower BTX dosing in the initial pain treatment session, to avoid adverse effects, followed by touch-up injections to eliminate any residual or additional pain areas.

After obtaining written informed consent, injection sites and dosing are pre-planned. Topical anesthesia is usually unnecessary if needle contact with the periosteum is avoided and if small volumes of concentrated injectant (1 mL preservative-free normal saline solution per 100 U of botulinum toxin serotype A [BTX-A]) and a 30 ½-inch gauge needle are used with deliberate and rapid injection techniques. In heavily muscled or obese patients, a longer needle, up to 1½ inches, may be required to reach symptomatic muscles in the cervical and thoracic paraspinal regions.

Unwanted diffusion of the neurotoxin behind the orbit (causing diplopia) or to the levator palpebrae superioris
(causing eyelid ptosis) is best avoided by performing periorbital injections with the patient sitting so that the head and neck are vertical. After craniofacial and some cervical injections, patients are instructed to remain in a vertical posture and to avoid touching or manipulating the injected areas for 2 to 3 hours. Increased headache pain

Figure. **A**, Frontal view with facial muscles relaxed. **B**, Frontal view with glabellar and midfrontal muscles contracted. **C**, Lateral view with facial muscles relaxed. mcs, Corrugator supercilii, medial portion; lcs, corrugator supercilii, lateral portion; p, procerus; ooc, orbicularis oculi; t, temporalis; spc, upper cervical splenius cervicis and capitus.
with muscle spasm at the injection sites may occur in about 20% of patients and is generally at its maximum about 2 to 3 days after treatment. Usually this adverse effect can be alleviated by manual physiotherapy or injection of a local anesthetic agent 8 to 10 days after the procedure; however, a second BTX-A session is often the most effective treatment. Guidelines for BTX-A dose ranges for specific muscles and injection sites are outlined in the Table. Commonly injected muscular sites and needle trajectories are illustrated in the Figure. It is notable that many characteristic injection sites contain small, nodular, tender trigger points (TrPs) in distribution patterns similar to those described by Travell and Simons.5

The desired degree of chemodenervation-induced paresis is determined by the muscle’s function, bulk, degree of spasm, and role in headache production. Dense paresis of glabellar muscles, which demonstrate facial emotion, can be compensated for in most people by eye expression. Conversely, the temporalis and masseter muscles work synergistically to accomplish mouth closure to facilitate mastication. Bruxism, associated with painful temporomandibular joint disorders, frequently influences migraine adversely. BTX dosages must be calculated to maintain masticatory function while providing sufficient therapeutic dosing to reduce pain.6 Therefore, dosing for pain relief should produce or preserve a balance of strength between the temporalis muscle and its synergistic partner, the masseter, which is also present side to side.6 Electromyographic guidance to assure correct needle placement into the masseter is useful, but usually unnecessary. The area within the masseter with symptomatic spasm, or TrPs, is contained and immobilized by grasping the muscle between the second and third fingers intraorally and placing the thumb on the skin next to the needle insertion site. Needle depth and placement into the target

---

### Table. Technical guidelines for botulinum toxin serotype A: Intramuscular injections for headache treatment*

<table>
<thead>
<tr>
<th>Muscle (Abbreviations‡)</th>
<th>Common injection sites</th>
<th>BTXA dosages (units)†</th>
<th>Needle insertion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frontalis f A,B</td>
<td>2-4 10-20</td>
<td>Perpendicular to skin</td>
<td></td>
</tr>
<tr>
<td>Corrugator supercilii mcs A,B,C</td>
<td>2.5-6 5-12</td>
<td>Inferiorly directed at ≤30° angle with the forehead and aligned with medial canthus of the eye</td>
<td></td>
</tr>
<tr>
<td>lateral portion lcs A, B</td>
<td>2.5-6 1.5-4</td>
<td>Perpendicular and slightly medial to the midpupillary line and placed about 1 cm above the eyebrow</td>
<td></td>
</tr>
<tr>
<td>Procerus p A, B</td>
<td>3-5 5-12</td>
<td>Perpendicular to skin</td>
<td></td>
</tr>
<tr>
<td>Orbicularis oculi ooc A, B</td>
<td>2-5 2-5</td>
<td>Perpendicular to skin</td>
<td></td>
</tr>
<tr>
<td>Temporalis t C</td>
<td>2-5 8-15</td>
<td>Perpendicular to skin</td>
<td></td>
</tr>
<tr>
<td>Upper cervical splenius cervicis and capitus spc</td>
<td>7.5-35 7.5-75</td>
<td>Cephalad at an approximate angle of 45° from vertical of the posterior cervical spine plane</td>
<td></td>
</tr>
<tr>
<td>Trapezius</td>
<td>Not shown 10-50 10-100</td>
<td>Perpendicular to site</td>
<td></td>
</tr>
</tbody>
</table>

*Guidelines are provided for botulinum toxin serotype A.
†Measurement units are for Botox (Allergan Pharmaceuticals, Irvine, California).
‡These abbreviations are used to mark common injection sites in the Figure.

---

Botulinum Toxin Injection Technique for Treatment of Headache

AESTHETIC SURGERY JOURNAL - JANUARY/FEBRUARY 2002

My Practice To Yours

67
are monitored, and any penetration of the needle intraorally should be discovered readily. BTX should not be injected until the needle has reached the intended target site and the operator is confident of correct placement. Performed correctly, BTX injection should not result in needle entry into the oral cavity. The needle can be withdrawn and placed through a new site with electromyogram guidance, if necessary. Needle reinsertion depends on whether BTX diffusion through the mucosal puncture site can be avoided; if it cannot, the procedure can be delayed while the puncture site heals and closes. BTX that is injected into the oral cavity, especially if swallowed, may have serious consequences if significant paresis of pharyngeal and laryngeal muscles occurs.

Upper cervical-occipital muscles, especially the splenius capitis and splenius cervicis, may trigger migraine. Frequently, these muscles also contribute to pain and headache by irritating the adjacent greater occipital nerve, causing concomitant neuralgic symptomatology. Thoracic paraspinal and periscapular muscles are frequently symptomatic and can trigger headache. Unwanted weakness of the supraspinatus and infraspinatus muscles, which form part of the rotator cuff, allows the humeral head to rise while injected trapezius and levator scapulae may cause the acromion to sag inferiorly and anteriorly. This can result in painful shoulder impingement 8 to 10 days after BTX-A treatment.

A BTX-A clinical effect is usually apparent at 7 to 10 days and plateaus at 3 weeks. The neuromuscular blocking action of BTX-A lasts 3 to 4 months; however, the reduction of pain can last substantially longer, and an effect more specific for migraine may continue to develop beyond 2 to 3 months after the injection session. Migraine improvement can be monitored with the use of a diary or another self-reporting method. Progress is indicated by reduction of oral prophylactic medications, improved response from abortive therapies, as well as reduced frequency, intensity, and severity of migraine headache symptoms. Nonpharmacologic headache therapies, such as biofeedback, cognitive-behavioral pain management strategies, and relaxation therapies, that were previously ineffective, may prove more successful after BTX chemodenervation and should be reconsidered as adjuncts to treatment. Injection techniques, dosages, and sequencing are currently under investigation for both commercially available BTX serotypes, Botox (type A) (Allergan Irvine, CA) and Myobloc (type B) (Elan, New York, NY), for headache and musculoskeletal pain treatment.

References