This policy has been developed through review of medical literature, consideration of medical necessity, generally accepted medical practice standards, and approved by the IEHP Pharmacy and Therapeutics Subcommittee.

**Drug:** Botox®/Botox Cosmetic® [Onabotulinum Toxin A (formerly known as Botulinum Toxin Type A)], Myobloc® (Rimabotulinum Toxin B), Dysport® (Abobotulinum Toxin A), Xeomin® (incobotulinumtoxinA)

**Class:** Neurotoxin (Botulinum Toxin or BTX)

**Formulary Medication:** N/A

**Line of Business:** Non-Medicare

**Effective Date:** May 18, 2016

**Revision Date:** May 18, 2016

<table>
<thead>
<tr>
<th>FDA Approved Indications (excluding cosmetic indication)</th>
<th>Botox®</th>
<th>Myobloc®</th>
<th>Dysport®</th>
<th>Xeomin®</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment of cervical dystonia in adult patients to decrease the severity of abnormal head position and neck pain</td>
<td>✔</td>
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<tr>
<td>Treatment of severe primary axillary hyperhidrosis inadequately managed with topical agents in adult patients</td>
<td>✔</td>
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<tr>
<td>Treatment of blepharospasm associated with dystonia, including benign essential blepharospasm or VII nerve disorders, in patients ≥ 12 years of age</td>
<td>✔</td>
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<td>For adult who were previously treated with Botox</td>
<td>✔</td>
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<tr>
<td>Treatment of strabismus in patients ≥12 years of age</td>
<td>✔</td>
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<tr>
<td>Treatment of spasticity (upper limb and lower limb) in adult patients</td>
<td>✔</td>
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<td></td>
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<tr>
<td>Treatment of upper limb spasticity in adult patients</td>
<td></td>
<td>✔</td>
<td>✔</td>
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<tr>
<td>Prophylaxis of headaches in adult patients with chronic migraine (≥ 15 days per month with headache lasting 4 hours a day or longer)</td>
<td>✔</td>
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<td>✔</td>
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<tr>
<td>Treatment of overactive bladder with symptoms of urge urinary incontinence, urgency, and frequency, in adults who have an inadequate response to or are intolerant of an anticholinergic medication</td>
<td>✔</td>
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<tr>
<td>Treatment of urinary incontinence due to detrusor overactivity associated with a neurologic condition (e.g. spinal cord injury, multiple sclerosis) in adults who have an inadequate response to or are intolerant of an anticholinergic medication</td>
<td>✔</td>
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Policy/Criteria:

Please note: FDA does not consider the various BTX products as interchangeable due to differences in concentration and/or dosing.

Cosmetic use will be not covered

*OnabotulinumtoxinA (Botox®)*

1. Strabismus
   a. Must be ≥ 12 years of age

2. Blepharospasm, including:
   a. Benign essential blepharospasm
   b. VII nerve disorders such as hemifacial spasm and facial nerve VII dystonia
   c. Must be ≥ 12 years of age

3. Spastic conditions
   a. Cerebral palsy including equines varus deformity
   b. Upper limb spasticity related to stroke, spinal cord injury, traumatic brain injury or related hemiplegia
   c. Hereditary spastic paraplegia
   d. Limb spasticity due to multiple sclerosis and other demyelinating diseases of the central nervous system
   e. Spastic hemiplegia

4. Dystonia Syndromes
   a. Cervical dystonia including spasmodic torticollis (e.g. Reduction of severity of abnormal head position and neck pain associated with cervical dystonia)
   b. Focal dystonia, including:
      - Organic writer’s cramp
      - Oromandibular dystonia/orofacial dyskinesia
      - Spasmodic dysphonia/laryngeal dystonia
      - Torsion dystonia

5. Chronic anal fissures
   a. Inadequate response to two classes of conventional treatment
      - Laxative: lactulose or Miralax
      - Topical nitroglycerin ointment†

6. Bladder dysfunction
   a. Must be ≥ 18 years of age
   b. Overactive bladder
      - Inadequate response to or intolerant of a trial of two antimuscarinic medications (e.g. oxybutynin, tolterodine, darifenacin †, solifenacin †, trospium †, fesoterodine †)

 OR
c. Urinary incontinence due to detrusor overactivity resulting from a neurologic condition (e.g. multiple sclerosis or spinal cord injury)
   • Inadequate response to or intolerant of at least two anticholinergic medication (e.g. oxybutynin, tolterodine, darifenacin †, solifenacin †, trospium †, fesoterodine †)

7. Laryngeal spasm/dystonia, Spasmodic dysphonia

8. Esophageal achalasia/cardiospasm with any of the following:
   a. Failure or clinically significant adverse effects to one conventional therapy (e.g. nitrates or calcium channel blockers)
   b. Ineligible for surgical treatment due to advance age or multiple co-morbidities
   c. High risk of complication of pneumatic dilatation or surgical myotomy
      • History of dilation induced perforation
      • Epiphrenic diverticulum or hiatal hernia
   d. Failed prior myotomy or dilation

9. Ptyalism/Sialorrhea, with both of the following:
   a. Excessive salivation associated with neurologic condition such as parkinsonism and/or cerebral palsy
   b. Inadequate response to an anticholinergic medication (e.g. glycopyrrolate, hyoscyamine, benztropine)

10. Prevention of chronic migraine headache, with all of the following:
    a. Must be ≥ 18 years of age
    b. At least 15 days per month with headaches lasting 4 hours a day or longer
    c. Failure or clinically significant adverse effects to a formulary triptan (e.g. sumatriptan, rizatriptan, naratriptan), AND
    d. Failure or clinically significant adverse effects to at least two classes of conventional migraine prevention medications
       • Beta blockers (e.g. propanolol, atenolol, metoprolol)
       • Antidepressants (e.g. amitriptyline, nortriptyline, doxepin)
       • ACE/ARB inhibitors (e.g. lisinopril, losartan, valsartan)
       • Calcium channel blockers (e.g. diltiazem, nifedipine, verapamil)
       • Anticonvulsants (e.g. gabapentin, topiramate, valproic acid)

11. Frey’s syndrome

12. Refractory upper extremity tremor that interferes with daily living
    a. Failure or clinically significant adverse effects to at least two different drug classes below:
       • Beta-blocker (e.g. propanolol)
       • Anticonvulsant (e.g. primidone, gabapentin, topiramate)
       • Benzodiazepine (e.g. alprazolam)

Note: † = Preferred non-formulary alternatives
Note: Electromyography may be required to determine the proper injection site(s).
RimabotulinumtoxinB (Myobloc®)

1. Cervical dystonia including spasmodic torticollis
   a. Must be ≥ 18 years of age

Incobotulinumtoxin A (Xeomin®)

1. Blepharospasm who were previously treated with onabotulinumtoxinA (Botox)
   a. Must be ≥ 18 years of age

2. Cervical dystonia including spasmodic torticollis
   a. Must be ≥ 18 years of age

3. Spastic conditions
   a. Cerebral palsy including equines varus deformity
   b. Upper limb spasticity related to stroke, spinal cord injury, traumatic brain injury or related hemiplegia
   c. Hereditary spastic paraplegia
   d. Limb spasticity due to multiple sclerosis and other demyelinating diseases of the central nervous system
   e. Spastic hemiplegia

AbobotulinumtoxinA (Dysport®)

1. Cervical dystonia including spasmodic torticollis
   a. Must be ≥ 18 years of age

2. Spastic conditions
   a. Cerebral palsy including equines varus deformity
   b. Upper limb spasticity related to stroke, spinal cord injury, traumatic brain injury or related hemiplegia
   c. Hereditary spastic paraplegia
   d. Limb spasticity due to multiple sclerosis and other demyelinating diseases of the central nervous system
   e. Spastic hemiplegia

If criteria are met, the request will be approved for up to 3 months or as recommended per FDA approved labeling, medical compendia, and/or per clinical guidelines in each respective disease state.

<table>
<thead>
<tr>
<th>Drug</th>
<th>FDA Recommended Dosing</th>
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<tbody>
<tr>
<td>Botox®</td>
<td>Maximum cumulative dose should not exceed 400 units in a 3 month interval</td>
</tr>
</tbody>
</table>

Note: FDA does not consider the various BTX products as interchangeable due to differences in concentration and/or dosing.
<table>
<thead>
<tr>
<th>Condition</th>
<th>Dose Details</th>
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</thead>
</table>
| Blepharospasm                   | - 1.25-2.5 units injected per site  
                                    | - Maximum 5 units injected per site  
                                    | - Maximum dose of 200 units from all sites in a 30-day period  
                                    | - May repeat treatment in 3 months                                             |
| Primary Axillary Hyperhidrosis  | - 50 units given intradermally per axilla                                    |
| Strabismus                      | - 1.25-5 units injected per site under electromyographic guidance  
                                    | - Maximum 25 units injected per site                                             |
| Upper Limb Spasticity          | - Treatment will vary depending on number of muscles involved, severity of spasticity, and patient response  
                                    | - Doses range from 75 units to 400 units divided among selected muscles  
                                    | - Maximum 50 units injected per site  
                                    | - May repeat treatment in 3 months                                             |
| Lower Limb Spasticity          | - Doses range from 300 units to 400 units divided among selected muscles  
                                    | - Maximum 25 units injected per site  
                                    | - May repeat treatment in 3 months                                             |
| Chronic Migraine                | - Total dose 155 units divided across 7 head/neck muscles  
                                    | - 0.1mL (5 units) injected per site  
                                    | - May repeat treatment in 3 months                                             |
| Overactive Bladder              | - Total dose 100-200 units  
                                    | - 0.5 mL (1.6 to 3.3 units) injection per site  
                                    | - May repeat treatment in 3 months                                             |
| Cervical Dystonia               | - Patient-specific, range 100-300 units (25<sup>th</sup>-75<sup>th</sup> percentile)  
                                    | - Maximum 50 units injected per site  
                                    | - Limit the total dose to the sternocleidomastoid muscle to 100 units or less may decrease the occurrence of dysphagia  
<pre><code>                                | - May repeat treatment in 3 months                                             |
</code></pre>
<table>
<thead>
<tr>
<th><strong>Myobloc®</strong></th>
<th><strong>Cervical Dystonia</strong></th>
</tr>
</thead>
</table>
| Refer to product package insert for further information | - Initial dose: 2,500-5,000 units divided among affected muscles  
- Retreatment every 12 to 15 weeks or longer as necessary (dosing range 5,000-10,000 units)  
- Maximum dose per site is site-specific and generally no greater than 1,000-5000 units per site  
- May repeat treatment in 3 months |
| Age Restriction: ≥ 18 years of age | |

<table>
<thead>
<tr>
<th><strong>Dysport®</strong></th>
<th><strong>Cervical Dystonia</strong></th>
</tr>
</thead>
</table>
| Refer to product package insert for further information | - Initial dose: 500 units IM in divided dose among affected muscles  
- Retreatment every 12 weeks or longer as necessary (dosing range 250-1000 units optimized clinical benefit)  
- Maximum dose per site is site-specific and generally no greater than 125-250 units per site  
- May repeat treatment in 3 months |
| Age Restriction: ≥ 18 years of age | |

| **Upper Limb Spasticity** | Treatment will vary depending on number of muscles involved, severity of spasticity, and patient response  
- Dosage of 500 units and 1000 units divided among selected muscles  
- May repeat treatment in 3 months |

<table>
<thead>
<tr>
<th><strong>Xeomin®</strong></th>
<th><strong>Maximum cumulative dose for any indication should not exceed 400 units in a treatment session</strong></th>
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</thead>
<tbody>
<tr>
<td>Refer to product package insert for further information</td>
<td><strong>Cervical Dystonia</strong></td>
</tr>
</tbody>
</table>
| Age Restriction: ≥ 18 years of age | - Initial dose: 120 units IM in divided dose among affected muscles  
- Retreatment every 12 weeks or longer  
- May repeat treatment in 3 months |

| **Blepharospasm** | - Initial dose: 1.25-2.5 units injected at each site or the same dose as the patient's previous treatment of onabotulinumtoxinA (Botox)  
- Maximum total initial dose in both eyes should not exceed 70 units (35 units per eye)  
- May repeat treatment in 3 months |

| **Upper Limb Spasticity** | Treatment will vary depending on number of muscles involved, severity of spasticity, and patient response  
- Dosage should not exceed 400 units divided among selected muscles  
- May repeat treatment in 3 months |
Clinical Evidence:


1. Hypersecretory Disorder
   - Botulinum Neurotoxin (BoNT) should be offered as treatment option to patients with axillary hyperhidrosis (Level A)
   - BoNT should be considered as a treatment option for palmar hyperhidrosis and drooling (Level B)
   - BoNT may be considered for gustatory sweating (Level C)

2. Neuro-Urologic Disorder
   - BoNT should be offered as a treatment option for neurogenic detrusor overactivity (Level A)
   - BoNT should be considered for detrusor sphincter dyssynergia in patients with spinal cord injury. (Level B)

3. Headache
   - BoNT injections should not be considered in patients with episodic migraine and chronic tension-type headaches


1. BoNT injection should be considered as a treatment option for:
   a. Blepharospasm (Level B)
   b. Cervical dystonia (Level A)
   c. Focal upper extremity dystonia (Level B)
   d. Adductor spasmodic dysphonia (Level B)
   e. Essential hand tremor in patients who failed treatment with oral agents (Level B)

2. BoNT injection may be considered as a treatment option for:
   a. Hemifacial spasm (Level C)
   b. Motor tics (Level C)

3. Insufficient evidence to support or refuse the use of BoNT in abductor spasmodic dysphonia (Level U)


1. BoNT injection should be offered as a treatment option for:
   a. To reduce muscle tone and improve passive function in adults with spasticity (Level A), and to improve active function (Level B)
   b. Equinus varus deformity in children with cerebral palsy (Level A)
   c. Adductor spasticity and for pain control in children undergoing adductor-lengthening surgery (Level B)
   d. Upper extremity spasticity in children (Level B)

American College of Gastroenterology 2013. Diagnosis and Management of Achalasia

- Botulinum toxin therapy is recommended in patients who are not good candidates for more definitive therapy with pneumatic dilation or surgical myotomy (strong recommendation, moderate quality evidence.)
Achalasia

*AGA (1999)* recommends either laparoscopic myotomy or graded pneumatic dilation (PD) in patients who are good surgical candidates. The choice between the two procedures depends on institutional preference and experience. In patients who are poor candidates for surgery or refuse surgery, initial treatment with BTX is the preferred approach. Available data indicate that BTX is effective in relieving symptoms initially in about 85% of patients; however, symptoms recur in more than 50% of patients within 6 months possibly because of regeneration of the affected receptors. Older patients (> 60 years) and those with vigorous achalasia are more likely to have a sustained response (up to 1.5 years) to BTX injection. In those responding to the first injection, 76% will respond to a second injection with decreasing response to further injections, usually from antibody formation to this foreign protein. Less than 20% of patients failing to respond to the first injection will respond to a second injection. Studies have shown that BTX is less effective than PD long term. Additionally, some reports indicate that cardiomyotomy may be more difficult and less effective in patients who were previously treated with repeated BTX injections, possibly because of submucosal scar formation in the esophagus at the site of injection. The long-term safety of repeated injections of BTX in achalasia is unknown. Therefore, BTX injection should be reserved for elderly patients or patients who are at high surgical risk or refuse PD and surgical myotomy.

Blepharospasm

*Costa et al (2004)* conducted a Cochrane review to evaluate the safety and efficacy of BTX-A in the treatment of blepharospasm. Participants of any age with a clinical diagnosis of idiopathic blepharospasm were eligible for inclusion. IM injections given in any administration schedule and by any injection technique, either EMG guided or not, was permitted. Previous therapy with BTX-A was allowed whether patients were still responding or not. The primary outcome measure for the meta-analysis was improvements in symptomatic rating scales (any). Secondary outcomes included changes in subjective evaluation of clinical status both by patients and clinicians, changes in quality of life assessments, adverse reactions (frequency and severity). The analysis included all randomized, controlled, double-blind trials of BTX-A vs. placebo. No suitable randomized, controlled trials fitting the criteria for inclusion in this meta-analysis were identified, and thus, all were excluded. Few controlled trials were found and they were of short duration and enrolled small numbers of patients. However, all of these trials found BTX-A to be superior to placebo as did large case-control and cohort studies, which reported that around 90% of patients benefited. The authors concluded that there are no high-quality, randomized, controlled efficacy data to support the use of BTX-A for blepharospasm. Despite this, other studies suggest that BTX-A is highly effective and safe for treating blepharospasm and support its use.

Hemifacial Spasm

*Costa et al (2005)* conducted a Cochrane review to evaluate the safety and efficacy of BTX-A for the treatment of hemifacial spasm (HFS). Participants of any age with a clinical diagnosis of HFS were eligible for inclusion. IM injections given in any administration schedule and by any injection technique, either EMG guided or not, were permitted. Previous therapy with BTX-A was allowed whether patients were still responding or not. The primary outcome for the meta-analysis was improvement in objective symptomatic rating scales (any). Secondary outcomes included changes in subjective evaluation of clinical status both by patients and clinicians, changes in QOL assessments, and adverse reactions (frequency and severity). Only one randomized, placebo-controlled trial was found involving 11 patients (3 male, 8 female) naïve to BTX-A therapy. All patients had been treated with medications unsuccessfully and one patient had undergone surgical microvascular decompressive procedures without lasting benefit. This was a cross-over trial during which patients underwent 4 sets of injections, comparing placebo (saline) with 3 different doses of BTX-A (Botox) (low dose [one-half of intermediate dose], intermediate
dose, and high dose [twice the intermediate dose]). Injections were given at least one month apart as clinically indicated; participants were not reinjected until any response to the previous injection had been lost. Selection of muscles to inject and dose administered were based on clinical involvement. For each participant, the site of injections was kept constant. The mean dose ranged from 2.5 to 10 units of BTX-A per muscle. The total dose administered at any one time varied between 5 and 90 units. The primary endpoint was subjective patient self-assessment of global improvement on a 10-point analog scale where 5 was the preinjection baseline and values < 5 represented improvement. Secondary outcomes included objective physician assessment of improvement assessed with a categorical 10-point scale to characterize the frequency of spasms (range, 0 to 3), number of muscles involved (range, 0 to 4), and severity of spasms (range, 0 to 3), adverse events, and duration of improvement. All outcomes were assessed one month after injections. For both subjective and objective evaluations, a change of at least 2 points was considered substantial. Duration of benefit was defined as the time for the participant to return to subjective and objective baseline after each injection. One participant withdrew after 2 injections because of concern about facial weakness caused by BTX-A. Two others withdrew for domestic reasons, after one and 3 injection sessions, respectively. The data from these 3 participants were used in the analysis of treatment efficacy and adverse events. Adverse effects were reported for BTX-A, affecting all 11 participants on a combined total of 30 occasions. These include facial weakness (29), bruising (6), diplopia (4), ptosis (2), headache (2) lagophthalmos, blurred vision, tearing, dysphagia, nausea, and flu-like symptoms all in one occasion. The distribution of adverse events between the various treatment groups and doses was not clear. The authors concluded that the findings of this single eligible trial support the results of large, open-label, case-control studies showing a benefit rate between 76% and 100%. Despite the lack of good quality controlled data, the authors concluded that BTX-A is probably effective and safe for treating HFS.

**Cervical Dystonia (CD)**

**BTX-A vs. Placebo**

*Costa et al (2005)* performed a Cochrane review to evaluate the safety and efficacy of IM injections of BTX-A for the treatment of CD. Thirteen randomized, placebo-controlled, blinded trials were included in the analysis. Eight trials enrolling 361 patients used the Botox formulation of BTX-A, while 5 trials enrolling 319 patients used the Dysport formulation. The studies were all short-term, ranging from 6 to 16 weeks in duration. The dose and technique of administration varied significantly between studies. The primary outcome for the meta-analysis was improvement in rating scales (all). For most of the trials, the primary outcome was the change from baseline in the Tsui scale at week 4 to 6. The Tsui scale grades severity of postural deviance (rotatocollis, antecollis, retrocollis, head tilt, and elevation of shoulder), acknowledges the presence or absence of head tremor, as well as whether the movements are continuous or intermittent; the score ranges from 0 to 25. This scale does not assess disability, pain, or other subjective symptoms. The mean change in the Tsui scale score at peak of BTX-A effect was between 2 to 3 points and the odds ratio for any improvement in Tsui scores was 5.47 (95% CI 3.5-8.5). The NNT was 3 (95% CI 3-4). Adverse events were transient and either mild to moderate or intermittent. The number of participants with adverse events was significantly higher with BTX-A than placebo [OR 2.1 (95% CI: 1.3 to 3.4)] and number needed to harm [NNH] 6 (95% CI 4-15). The adverse events included neck weakness, dysphagia, dry mouth/sore throat, voice change/hoarseness, and injection site pain. The authors concluded that a single injection of BTX-A was safe and effective for treating CD. Trials that included patients previously treated with BTX-A suggest that further injection cycles continue to work for most patients. Adverse effects tended to be transient and rarely severe.

**BTX-B vs. Placebo**

*Costa et al (2004)* conducted a Cochrane review to evaluate the safety and efficacy of BTX-B for the treatment of CD. The analysis included 3 multicenter, randomized, placebo-controlled, parallel-group trials conducted in the US in the 1990s and included a total of 308 subjects over age 18 (mean age 50). The primary outcome for the meta-analysis was improvement in rating scales (all). All 3 trials used the change in the TWSTRS total score at week 4. The authors concluded that a single injection of BTX-B
was safe and effective for treating CD. Long-term uncontrolled studies suggested that further injection cycles continue to work for most patients.

**BTX-A vs. Anticholinergics**

*Costa (2005)* conducted a Cochrane review to evaluate the safety and efficacy of BTX-A vs. anticholinergic drugs in the treatment of CD. Only one trial suitable for inclusion was found; thus, no meta-analysis was performed. The trial included in the analysis was a multicenter, double-blind, double-dummy, placebo-controlled, study in which patients were randomized to trihexyphenidyl (Artane®) 1 mg orally once daily, increased every 3 days to a maximum of 6 mg four times daily (mean dose 16.25 mg/day, range, 4 to 24) (n = 33) or BTX-A (Dysport) IM injections (mean dose 292 units: range, 38 to 440 units) at baseline and at week 8 (mean dose 262 units: range, 36 to 440). The selection of muscles to inject and the number of injection sites per muscle were based on the investigator criteria. For the primary outcome was the change in TWSTRS disability score. The authors gave the mean change (-4 in the trihexyphenidyl group and +2 in the BTX-A group) and the level of significance for this difference in medians (p = 0.0023 [95% CI: 4 to 12]). The authors commented that more participants in the BTX-A group experienced pain relief, but did not give exact numbers. The mean improvement in TWSTRS pain scale score was 1 point in the trihexyphenidyl group and 3 points in the BTX-A group; the SD for this difference was not provided, but the authors reported that it did not reach statistical significance. There were no serious adverse events. The authors concluded that the available evidence suggests that BTX-A injections provide more objective and subjective benefit than trihexyphenidyl to patients with CD, but no conclusions could be drawn regarding superiority over anticholinergics.

**Focal Limb Dystonia**

*AAN (2008)* conducted a meta-analysis to evaluate the safety and efficacy of BTX in the treatment of focal limb dystonia. Two trials met criteria. One randomized placebo-controlled trial (N=40) gave one injection and were offered another injection at 1 month. The primary endpoint was based on patient reported self evaluation. Based on patient response, 70% of those randomized to BTX wished to continue treatment compared to 32% of those receiving placebo (p =0.03). Significant improvement was also found in BTX-injected subjects compared to those receiving placebo in secondary outcome measures including a visual analog scale, symptoms severity scale, writer’s cramp rating scale, and assessment of writing speed, but not in the functional status scale. Temporary weakness and pain at the injection site were the only adverse events reported. Another RCT found was a prospective, double-blind, crossover study of 17 patients with several forms of limb dystonia. Subjects received a series of four injections in random order, including placebo. Using a patient subjective scale, 82% of patients receiving BTX had benefit compared to 6% (one patient) who received placebo. Using physician rating of videotapes, 59% improved with active treatment and 38% with placebo (not significant). There was no dose-response relationship for benefit, and there was a large degree of interobserver variability. BTX has shown some efficacy for the treatment of focal upper extremity limb dystonia, but the data is limited and not well defined.

**Hypersecretory Disorders**

Primary focal hyperhidrosis is a chronic idiopathic disorder of excessive sweating, which most often affects the axillae, palms, soles, and forehead. Treatment options include topical or systemic pharmacological therapy, iontophoresis, or surgical procedures. In a randomized, placebo-controlled, double-blind study of 320 subjects with axillary hyperhidrosis, 242 patients received BTX and 78 received saline placebo intradermally. Patients receiving BTX had a higher response rate (more than 50% reduction of sweat production compared to baseline sweating) at all time points than those receiving placebo (82% to 95% vs 20% to 37%; p<0.001). In another RCT study of 145 patients with axillary hyperhidrosis, BTX was injected into one axilla and placebo was injected into the other. At week 2, sweat production was reduced in the axilla that had received BoNT as compared with the placebo-injected side (p < 0.001).
**Migraine**

*Episodic migraine* is a headache that is typically throbbing and often unilateral, usually accompanied by photophobia, phonophobia, nausea, or vomiting. The presence of focal neurological symptoms defines migraine with aura. Pharmacological agents are the mainstay for acute and prophylactic treatment of most forms of headache.

Botox was evaluated in two randomized, multi-center, 24-week, 2 injection cycle, placebo-controlled double-blind studies. Study 1 and Study 2 included *chronic* migraine adults who were not using any concurrent headache prophylaxis, and during a 28-day baseline period had >15 headache days lasting 4 hours or more, with >50% being migraine/probable migraine. In both studies, patients were randomized to receive placebo or 155 Units to 195 Units Botox injections every 12 weeks for the 2-cyle, double-blind phase. Patients were allowed to use acute headache treatments during the study. Botox treatment demonstrated statistically significant improvement of headache frequency compared to placebo (-7.8 days vs. -6.4 days) and cumulative hours of headache (-107 hours vs. -70).

**Neurogenic bladder**

Patients with neurogenic bladder suffer from detrusor overactivity (detrusor hyperreflexia), which may be combined with detrusor sphincter dyssynergia (DSD; uncoordinated voiding). Both conditions cause high intravesical pressure and can lead to upper urinary tract damage. Treatment for both DSD and detrusor overactivity include pharmacological therapy, catheterization, and surgery.

*Schmid (2006)* evaluated the safety and efficacy of BTX-A (unknown formulation) injections in the detrusor muscle to treat patients with idiopathic overactive bladder (IDO) resistant to conventional treatment such as anticholinergics in a multicenter, open-label case series. A total of 100 patients were consecutively injected with BTX-A 100 units into the detrusor muscle at 30 sites. All patients were asked to gradually taper their anticholinergic medication(s) within 1 week after BTX-A administration and to completely discontinue it after that time. Primary endpoints were daytime frequency (DF), nocturia (N), urge incontinence episodes, and the need to change pads per 24 hours, recorded in 3-day voiding diaries, as well as subjective cure of urgency using a 3-point scale (3 = strong urgency; 2 = moderate/greater than 50% decreased urgency; 1 = no urgency). Overall, 88% of patients showed significant improvements in bladder function in regard to subjective symptoms (excellent/very satisfied or improved/satisfied) as well as urodynamic parameters after 4 and 12 weeks (p < 0.001). Within 1 to 2 weeks (mean 5 days) after BTX-A injections, urgency completely disappeared in 72 of 100 patients (72%) at the 4-week assessment and in 66% at the 12-week follow-up. Incontinence, which was initially present in 84 patients, completely disappeared in 74% at the 4-week follow-up and in 80% at 12 weeks. This was also reflected in a significant decrease in the median number of pads changed per 24 hours. Mean DF decreased significantly from 13.5 to 7 micturition daily (-50%) after 4 and 12 weeks (p < 0.0001), then minimally increased to 8 micturition daily after 36 weeks. Mean N decreased from 4 to 1.5 micturition nightly after 4 and 12 weeks (p < 0.0001), then slightly increased to 2.1 micturition nightly at 36 weeks. The mean duration of effect was 6 months (range, 5 to 9); a slight to moderate decrease in the maximal effect was noted in 20 patients with a complete 9-month follow-up. The same tendency was observed in another 16 patients lacking 9-month urodynamic evaluations. Incontinence was still absent in 7 patients (33%), mild in 10 (50%), and severe in 3 (17%), whereas urgency was moderate in 83% and strong in 17%. QOL assessments at 4 and 12-week follow-ups revealed a statistically significant improvement from baseline in all urge-related items evaluated by KHQ (p < 0.001). Ninety percent of patients experienced improvement in ≥1 KHQ category, including ability to travel, effect on sleep, participation in social life, accomplishment of household tasks, and general effect on daily life. This positive effect increased at the 3-month follow-up and then decreased somewhat at 9 months. The authors concluded that intradetrusor BTX-A injections may be an efficient and safe treatment option in patients with severe idiopathic overactive bladder resistant to all conventional treatments; improvement in symptoms may be seen for at least 6 months after treatment.
Schurch et al (2005) evaluated the safety and efficacy of BTX-A for the treatment of neurogenic urinary incontinence in a randomized, double-blind, placebo-controlled trial. A total of 59 patients with urinary incontinence caused by neurogenic detrusor overactivity (NDO) (due to spinal cord injury in 53 and multiple sclerosis in 6) requiring clean intermittent self-catheterization (CIC) were randomized to receive a single IM injection into the detrusor muscle of BTX-A 200 units (n = 19) or 300 units (n = 19) or placebo (n = 21). Primary endpoint was change in daily frequency of urinary incontinence episodes monitored using a patient diary. Follow-up visits occurred at weeks 2, 6, 12, 18, and 24. QOL was assessed using the Incontinence Quality of Life (I-QOL) Questionnaire. The results showed that there were significant decreases in incontinence episodes at all time points in the two BTX-A groups, except at weeks 12 and 18 in the BTX-A 200 unit group and there were none in the placebo group. The decrease in the BTX-A groups represented a reduction in incontinence episodes of ~50% and was statistically significant (P < 0.05). The authors concluded that IM injections of BTX-A into the detrusor muscle can provide rapid, well tolerated, clinically significant decreases in signs and symptoms of urinary incontinence caused by NDO during a 24-week period.

Spasticity

AAN (2008) A meta-analysis completed by American Academy of Neurology in 2008 found 11 RCT studies in adult upper extremity spasticity (BTX-A =10; BTX-B =1). All but one used measurements of tone as the primary endpoint. All of the studies demonstrated that BTX is safe and reduced tone in a dose dependent manner; however, resistance to passive movement was not shown to correlate with improvement in active function (defined as activities that the subject can voluntarily perform with the spastic limb). For lower extremity spasticity, 3 RCT studies were found. Most studies focused on reduction in muscle tone with demonstrated efficacy, but only few measured changes in gait. One placebo-controlled crossover protocol reported a non-significant 17% increase in walking speed after BoNT injection into calf muscles in spastic hemiparesis. Another placebo-controlled study failed to demonstrate gains in walking speed. Overall, the data appears to be non-significant for lower extremity spasticity. The authors concluded that the recommended doses of BoNT injection into specific muscles have been derived predominantly from expert consensus rather than dose-response studies. BTX has been shown to be effective in the treatment of adult spasticity in the upper limb in reducing muscle tone and improving passive function, while the data related to lower spasticity has not been established. Improvement in active function has not been shown in the data. There are no controlled studies comparing BTX to other treatment modalities for spasticity. Currently, there is a lack of data to determine efficacy of BoNT for spasticity in children.

Wasiak (2004) conducted a Cochrane review to evaluate the safety and efficacy of BTX-A as an adjunct to managing the upper limb in children with spastic cerebral palsy (CP). Participants between 0 and 19 years of age requiring treatment for upper limb spasticity and muscle tone secondary to CP were eligible for inclusion. The analysis included all randomized controlled trials comparing IM BTX-A injections of any dosage into any muscle group of the upper limb compared with either placebo; no other treatment, or other interventions. Only two trials met inclusion criteria and there were no outcome measures in common between the 2 included trials; thus, data could not be combined for a meta-analysis. In the first randomized, controlled, double-blind trial, the effects of BTX- A (either Botox 90 to 250 units at 4 to 7 units/kg or Dysport 160 to 400 units at 8 to 9 units/kg) were compared with placebo (normal saline) on the hemiplegic upper limb in 14 patients with CP (5 male, 9 female, mean age 9 years). The primary endpoints were active range of motion (ROM) of metacarpal phalangeal (MCP); wrist and elbow extension; thumb in palm position for both thumb extension and abduction; Ashworth scale (a widely used 5-point scale used to measure spasticity of central or peripheral origin ranging from 0 to 5, i.e., no increase in tone to limb rigid in flexion or extension) for thumb, wrist, and elbow tone; wrist resonance frequency (tone); grasp and release of an empty capsule scored using a modified Reddihough scale, and the number of transfers of a coin. Median change and range data were provided. The second randomized, controlled, assessor-blind trial compared BTX-A (Botox 2 to 6 units/kg) in conjunction with occupational therapy with occupational therapy alone in 30 children (20 male, 10 female) aged 2 to 10 years diagnosed
with hemiplegic CP and moderate spasticity of the elbow, wrist, or thumb with a modified Ashworth score \( \geq 2 \); subjects had full passive range and the ability to initiate voluntary movement of the digits. The primary outcome was the Quality of Upper Extremity Skills Test (QUEST). Secondary endpoints were the Pediatric Evaluation of Disability Inventory (PEDI); sphygmanometer measurements of grip strength; modified Ashworth scale for elbow, wrist, and thumb extension and forearm supination; and passive elbow and wrist extension, supination, and thumb abduction. Study 1 reported at 12 weeks, the grasp and release score, tone at the wrist, and wrist resonance frequency improved significantly more in the BTX-A group than the placebo group. Study 2 reported at 1 month the QUEST changes score favored better quality of movement in the BTX-A group, the change in PEDI scores were higher in the BTX-A group, and increase in ROM at the elbow and towards supination were greater in the BTX-A group compared to placebo. The grip strength decreased in the BTX-A group at 1 and 3 months and increased at 6 months. There was, however, little consistent difference in change between groups on the modified Ashworth scale. The mean changes for these trends in favor of the BTX-A group were small. The authors concluded that this systematic review did not find sufficient evidence to support or refute the use of IM injections of BTX-A as an adjunct to managing the upper limb in children with spastic cerebral palsy. Only one of the two identified randomized controlled trials reported some promising results in support of reduced muscle tone following BTX-A injections.

Ade-Hall (2000) conducted a Cochrane review to evaluate the safety and efficacy of BTX-A for the treatment of lower limb spasticity in children with CP. Participants between 0 and 19 years of age requiring treatment for lower limb spasticity secondary to CP were eligible for inclusion. Three studies met inclusion criteria, but meta-analysis was not possible because the results were presented in an incompatible form. Where appropriate, a Peto OR with a 95% CI was calculated. Study 1 (n = 12) compared BTX-A to placebo in a double-blind fashion. Outcome measures included a physician rating scale (PRS), Biodex isokinetic computerized dynamometry, physiotherapy evaluations, parent/guardian assessment. Eighty-three percent (5) of children who received BTX-A and 33% (2) who received placebo had an improved gait pattern (PRS) 4 to 6 weeks after the intervention. Statistical significance was not reported. Study 2 and 3 compared BTX-A to plaster casts; however, each trial reported the results in different ways, precluding a pooled statistical analysis of the data. Two children were lost from the BTX-A group following randomization in Study 3. Each study reported statistically significant improvements in gait pattern (PRS) for both the BTX-A group and the cast group at 12 weeks (Study 2) and 6 months (Study 3) following intervention. However, neither study was able to show a significant difference between the groups. Study 3 used the gross motor function measure (GMFM) to measure changes in standing function and dynamic function. There was a significant improvement following administration of BTX-A and of casts, but no significant difference between the improvements of the 2 groups. Study 2 assessed 12 out of 20 children using 3D gait analysis and found the improvement in maximal ankle dorsiflexion and plantar flexion at 12 weeks post intervention to be significantly greater in the children who had received BTX-A compared to those who had worn casts. The other gait parameters did not show any significant differences between the groups. Muscle tone, rated on the Ashworth scale, improved significantly for both groups in Study 3; however, there was no significant difference between the groups. Study 2 found no significant change in muscle tone in either group. Passive range of ankle dorsiflexion was significantly improved for each group in Study 3, but only for the BTX-A group in Study 2. The difference between groups was not significant in either trial. Study 3 questioned parents on their satisfaction with treatment (rather than their perception of how well treatment had worked). All the reported comments from the BTX-A group were positive, as were some from the cast group. The negative comments came from the cast group and included inconvenience and weakness of legs following their removal. The two authors who compared BTX-A with casts also compared the cost of administration of each treatment and concluded that once parental time and travel expenses had been taken into account, the two treatments were cost comparable. The authors concluded that this systematic review did not reveal strong controlled evidence to support or refute the use of BTX-A for the treatment of leg spasticity in CP.

Cardoso et al (2005) performed a meta-analysis evaluating the safety and efficacy of BTX-A in the management of patients with upper limb spasticity following stroke. Five randomized, double-blind, placebo-controlled trials meeting the eligibility criteria were included in the analysis. The study participants had not previously received other pharmacological or surgical treatment for spasticity and all...
were receiving physiotherapy. The primary efficacy measure in all but one study was muscle tone activity using the modified Ashworth scale (MAS) or Global Assessment Score (GAS). All of the studies described the clinical data referring from the period between the fourth and sixth weeks after BTX-A administration. Clinical improvement at week 4-6 after injection assessed with the MAS was significantly higher in the BTX-A group compared to placebo in all of the included studies (WMD = 0.95, 95% CI: 0.74 to 1.17, Z = 8.57, p < 0.00001). Mean MAS score was also higher when wrist joint was included at the same endpoint (Z = 8.44, p < 0.00001). The mean GAS scores improvement was significantly higher in all parameters in the BTX-A group (WMD = 1.11, 95% CI: 0.81 to 1.41, Z = 7.32, p < 0.00001). Two of the 3 studies assessing GAS did not show statistically significant differences between BTX-A and placebo; however, when all studies were analyzed, BTX-A showed a significantly better therapeutic response compared to placebo (OR = 3.27, 95% CI: 1.38 to 7.74). Although the outcomes showed that BTX-A resulted in significantly greater reduction in muscle tone compared to placebo, the overall effect on functional disability was not fully observed in the majority of studies. Most of the studies did not employ functional or QOL measures. Also, the studied population had different times of post-stroke spasticity and some patients may have adapted to their spasticity. The authors concluded that BTX-A was superior to placebo in reducing upper limb spasticity after stroke and was well tolerated; however, no data is available regarding the long-term use of BTX-A.

**Strabismus**

*Botox Package Insert (2006)* describes experience with 667 adults (aged 12 to 90 years) and 356 children (aged 2 months to 12 years) with strabismus treated with one or more injections of BTX-A into the extraocular muscles. Fifty-five percent of patients in the adult group with esotropia (n = 384) improved to an alignment of ≤ 10 prism diopters (PD) when evaluated at a follow-up of 6 to 83 months (average 17 months); in those patients with exotropia (n = 293), 52% improved to an alignment of ≤ 10 PD. Sixty-five percent of patients in the child group with esotropia (n = 261) improved to an alignment of ≤ 10 PD as did 47% with exotropia (n = 95) when evaluated at a follow-up of 6 to 65 months (average 27 months).

**Spasmodic Dysphonia**

*Watts (2004)* conducted a Cochrane review to evaluate the safety and efficacy of BTX for the treatment of spasmodic dysphonia (SD). All randomized controlled trials that compared the use of BTX to placebo, no treatment, or alternative treatments in adults with a primary diagnosis of adductor, abductor, or mixed SD were eligible for inclusion in the analysis. Experimental interventions included any unilateral or bilateral injection of BTX into a muscle or muscles of the laryngeal mechanism. There was no restriction on dosage, number of treatments or time to outcome measure. Only one study met the inclusion criteria based on methodological quality and availability of appropriate data for analysis; thus, a meta-analysis was not possible. This was a randomized, double-blind, placebo-controlled, cross-over trial evaluating the effects of BTX-A (Botox) on voice quality (via spectrographic analysis), perceived voice improvement, and acoustic measures in 13 subjects with adductor SD. The results showed that BTX-A produced significantly decreased perturbation and fundamental frequency range compared to placebo. The BTX-A group also showed a significant improvement in ratings of speech quality (spectrographic analysis) and perceived improvements compared to placebo (for both self and independent ratings. Data provided for the Self Rating of Improvement did not allow for a calculation of effect. Outcome measures were assessed at 4 days post treatment and an average improvement lasting 3 months was reported. Breathiness was reported as an adverse effect in 2 subjects. No information was provided with regard to the measurement of vocal production beyond the 4 days. Other studies published in the literature have reported that the effects of BTX typically last between 3 and 12 months. The authors concluded that the randomized controlled trials published in the literature have demonstrated a benefit of BTX treatment in subjective measures of voice production and select acoustic and aerodynamic variables. However, due to the small number of studies available and methodological differences, no firm conclusions can be drawn regarding the efficacy of BTX for all types of SD or for patients with different behavioral or clinical characteristics.
A randomized placebo-controlled study (N=25) injecting either 50 units of BTX-A (Botox®) or placebo into the wrist flexors and extensors of the dominant limb, found that BTX produced significant improvement on the tremor severity rating scale 4 weeks after injection compared to placebo. Postural accelerometry measurements showed a 30% reduction in amplitude in 9 of 12 BTX-treated subjects and in 1 of 9 placebo-treated subjects (p < 0.05). Oral agents still continue to be considered first line therapy (ex. propranolol and primidone). According to American Academy of Neurology 2008, there is presently no data comparing the efficacy of BTX to other treatment modalities and BTX should be reserved as 2nd line treatment.

Reference:


