ENDOSCOPIC BOTULINUM TOxin INJECTION FOR CRICOPHARYNGEAL DYSPHAGIA

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Twelve patients underwent 17 endoscopic injections of botulinum toxin type A in the cricopharyngeus muscle for the treatment of dysphagia and cricopharyngeal spasm over a 3-year period. The patient's charts were reviewed. Preoperative and postoperative symptoms, examination, and swallowing studies were reviewed. Eleven of the 12 patients had improvement in their symptoms, which lasted for a mean of 3.8 months. Two patients elected cricopharyngeal myotomy for permanent correction of their dysphagia. There was 1 case of postoperative neck cellulitis in an immunocompromised patient undergoing simultaneous excision of a thyroglossal duct cyst. We conclude that endoscopic injection of botulinum toxin is a relatively safe and viable technique for the treatment of dysphagia associated with cricopharyngeal spasm. It requires simple tools readily available to otolaryngologists. Larger, prospective controlled studies are necessary to establish its effectiveness and role in the management of this condition.

KEY WORDS — botulinum toxin, cricopharyngeus, dysphagia.

INTRODUCTION

The cricopharyngeus (CP) muscle (upper esophageal sphincter) attaches to the lateral aspect of the cricoid cartilage and separates the hypopharynx from the esophagus. It is innervated by the recurrent laryngeal nerves and pharyngeal plexus. When functioning properly, this sphincteric muscle maintains esophageal closure during inspiration and between swallows, and briefly relaxes in coordination with the swallow to allow for bolus transit. It prevents the reflux of gastric and esophageal contents into the hypopharynx during inspiration. It also prevents air from entering the esophagus during inspiration. Dysphagia may result from CP muscle dysfunction.

The diagnosis of CP muscle spasm or hypertonicity begins with careful history-taking and can be confirmed with a wide variety of studies, including modified barium swallow study, esophageal manometry, and electromyography (EMG) of the CP muscle, which show persistent spasm of the CP muscle during the swallow. Symptoms may include a cervical "block" dysphagia in which primarily solid foods get caught up at the cricoid level. Patients may also describe choking symptoms, multiple attempts at swallowing the bolus, and nasopharyngeal reflux. Consequences may include weight loss, aspiration pneumonia, episodes of asphyxia due to airway obstruction, use of alternative food consistencies, and dependence on nonoral feedings.

A wide variety of disorders may affect the CP muscle and cause dysphagia. These include 1) various neurologic disorders such as amyotrophic lateral sclerosis or multiple sclerosis, 2) cerebral vascular accidents, 3) injuries to the pharyngeal plexus of nerves or the recurrent laryngeal nerves during head and neck surgery, 4) pharyngeal diverticula, and 5) idiopathic conditions.

Symptoms of CP dysphagia have been treated in the past with mechanical dilation, pharyngeal plexus neurectomy, and CP myotomy. McKenna and DeDo reported on their experience in performing 54 CP myotomies; they advocate patient selection based on careful history-taking alone. Patients with CP dysphagia may have previously had normal findings on manometric or cineradiographic studies. They advocate CP myotomy as both a diagnostic and a therapeutic modality in patients with CP dysphagia.

More recently, botulinum toxin type A (Botox) has been advocated for the diagnosis and management of CP dysphagia. Botox has been used effectively for the treatment of a number of hyperkinetic disorders, such as blepharospasm, torticollis, orofacial dystonia, spasmodic dysphonia, and CP spasm that resulted in poor voice in tracheoesophageal puncture speakers. Botulinum exotoxin is a large protein molecule that after intramuscular injection binds rapidly and irreversibly to the presynaptic cholinergic nerve terminals. It thereby impairs the release of acetylcholine at the neuromuscular junction, causing a dose-related weakness of the innervated muscle. Its effects are mainly localized to the area in which it is administered, resulting in a process referred to as...
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SUMMARY OF PATIENT DATA

<table>
<thead>
<tr>
<th>Pt No.</th>
<th>Age (y)</th>
<th>Sex</th>
<th>Basic Disease</th>
<th>Modified Barium Swallow Study</th>
<th>Botox Dose (mouse units)</th>
<th>% Improvement</th>
<th>Duration (mo)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>52</td>
<td>M</td>
<td>Chemotherapy and irradiation for squamous cell carcinoma of hypopharynx</td>
<td>Poor contraction of pharyngeal constrictors; poor relaxation of cricopharyngeus</td>
<td>10, 15, 20, 25</td>
<td>25, 25, 50, 75</td>
<td>3-6</td>
</tr>
<tr>
<td>2</td>
<td>72</td>
<td>M</td>
<td>Cerebrovascular accident</td>
<td>Pooling in pyriform sinuses</td>
<td>15</td>
<td>50</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>58</td>
<td>M</td>
<td>Idiopathic</td>
<td>Poor relaxation of cricopharyngeus</td>
<td>15</td>
<td>50</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>76</td>
<td>M</td>
<td>Idiopathic</td>
<td>Hypopharyngeal pooling</td>
<td>15</td>
<td>25</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>63</td>
<td>M</td>
<td>Total laryngectomy for squamous cell carcinoma of larynx</td>
<td>Poor relaxation of cricopharyngeus</td>
<td>15</td>
<td>75</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>69</td>
<td>M</td>
<td>Total laryngectomy for squamous cell carcinoma of larynx</td>
<td>Poor relaxation of cricopharyngeus</td>
<td>15, 30</td>
<td>50, 75</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>71</td>
<td>F</td>
<td>Amyotrophic lateral sclerosis, dysphagia</td>
<td>Poor relaxation of cricopharyngeus</td>
<td>25</td>
<td>25</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>75</td>
<td>M</td>
<td>Cerebrovascular accident, unilateral true vocal fold motion impairment</td>
<td>Poor relaxation of cricopharyngeus</td>
<td>15, 30</td>
<td>50, 75</td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>58</td>
<td>M</td>
<td>Total laryngectomy for squamous cell carcinoma of larynx</td>
<td>Poor relaxation of cricopharyngeus</td>
<td>20</td>
<td>75</td>
<td>6</td>
</tr>
<tr>
<td>10</td>
<td>86</td>
<td>F</td>
<td>Parkinson's disease, small vessel disease, arteriosclerosis</td>
<td>Pharyngeal dysphagia</td>
<td>15</td>
<td>25</td>
<td>3</td>
</tr>
<tr>
<td>11</td>
<td>80</td>
<td>F</td>
<td>Idiopathic cervical dysphagia</td>
<td>Poor relaxation of cricopharyngeus</td>
<td>15</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>12</td>
<td>69</td>
<td>F</td>
<td>Idiopathic cervical dysphagia</td>
<td>Poor relaxation of cricopharyngeus</td>
<td>20</td>
<td>No follow-up</td>
<td>No follow-up</td>
</tr>
</tbody>
</table>

In the current literature, the treatment of CP dysphagia with Botox has been described in a small number of patients with short follow-up; both percutaneous and endoscopic techniques were used. In the current study, we set out to review our experience over the past 3 years with endoscopic injection of botulinum toxin for the treatment of dysphagia related to CP muscle dysfunction.

MATERIALS AND METHODS

Design. A search of the otolaryngology patient database identified 12 patients who underwent endoscopic injection of botulinum toxin into the CP muscle between July 1997 and June 2000. All patients were referred by a speech and language pathologist after modified barium swallow study. A retrospective chart review was performed of these patients. Preoperative and postoperative symptoms, examination findings, and videofluoroscopic swallowing study findings were reviewed.

Technique. All procedures were performed in the operating room under a brief-acting general anesthetic. An adult Dedo laryngoscope was inserted into the upper esophagus, and the patient was suspended with a Lewy suspension apparatus on a Mayo stand with the CP muscle in view. A 7-inch, 22-gauge spinal needle (Becton Dickinson and Co, Franklin Lakes, New Jersey) attached to a 3-mL Luer Lock syringe was inserted under direct visualization into the CP muscle. Freshly reconstituted, purified botulinum toxin type A (Botox, Allergen Inc, Irvine, California) at a 2.5-mouse units (MU)/0.1 mL concentration was injected into 3 sites — 1 posterior and 2 lateral — in the muscle after initial aspiration to ensure that the needle was not placed in an intravascular site. The patients were observed after operation in the recovery room and subsequently discharged home. A postoperative modified barium swallow study was performed between 2 and 3 weeks after the procedure. The patients were asked to return for follow-up at 1 month and again when their swallowing function had returned to the preoperative level. At follow-up, they were asked to rate the level of improvement in their swallowing function as compared to their preoperative state by quartiles, taking into account the consistency of food consumed, the length of time required for meals, and coughing and choking episodes during meals.

RESULTS

The Table summarizes the clinical results of the
patients reviewed. There were 8 men and 4 women. Their ages ranged from 52 to 86 years, with an average age of 68 years. There were 3 patients who had undergone total laryngectomy for squamous cell carcinoma of the larynx, and 1 patient who was treated with chemotherapy and irradiation for hypopharyngeal carcinoma. There were a total of 4 patients with neurologic causes for CP dysphagia: 2 with cerebrovascular accidents, 1 with amyotrophic lateral sclerosis, and 1 with Parkinson’s syndrome and small vessel atherosclerotic disease. There were 4 patients with idiopathic cervical dysphagia; 1 had undergone right upper lobectomy for carcinoma, but had normal true vocal fold function. The most common finding on preoperative swallowing study was a narrow upper esophageal sphincter with anterior bulging of the CP muscle and failure to relax during swallowing. Other findings included pooling of secretions in the hypopharynx and poor contraction of the pharyngeal constrictor muscles.

Three patients underwent multiple Botox injections, whereas the remaining 9 patients underwent 1 procedure each. The doses of botulinum toxin ranged from 10 to 30 MU, with an average dose of 19 MU. All patients were seen in follow-up at 1 month after operation and then again when symptoms of preoperative dysphagia returned. One patient was lost to follow-up. All patients reported between 25% and 100% improvement in their swallowing function as compared to their preoperative status, with an average improvement of 53%. This improvement included less difficulty passing the bolus, faster consumption of food, and less coughing and choking during meals. The duration of improvement was between 3 and 6 months, with an average duration of 3.8 months. Postoperative modified barium swallow study was performed after 11 of the 17 injections. In 8 of these, there was no obvious difference from the preoperative examination.

One patient, who underwent concomitant excision of a thyroglossal duct cyst, developed neck cellulitis after operation that resolved with intravenous antibiotic therapy. One patient did not come for any postoperative follow-up. Two patients elected to undergo CP myotomy for permanent correction of their dysphagia. Four patients received additional injections periodically — 1 of these after the study period ended. Of the remaining 5 patients, the 3 with only 25% improvement in their symptoms chose not to have further therapy, and 2 died of unrelated causes.

DISCUSSION

Botulinum toxin injection into the CP muscle has been a useful addition to the otolaryngologist’s armamentarium for the treatment of cervical dysphagia. Schneider et al10 first injected Botox for the treatment of CP dysphagia in 1994, using EMG guidance with endoscopy in 7 patients. Five of their 7 patients subjectively experienced complete relief or marked improvement in their swallowing symptoms. Blitzer and Brin11 in 1997 described a percutaneous, EMG-guided approach for Botox injection as being both diagnostic and therapeutic for this condition. All 6 patients in the study had improvement as judged by decreased pooling on the modified barium swallow study.

Both of these groups relied on EMG, which may not be available to most practitioners. In addition, the percutaneous approach may not be reliable in inexperienced hands and is somewhat uncomfortable for patients because it requires rotation of the larynx; it is also very difficult to locally anesthetize the entire path of injection. Ahsan et al8 more recently described an endoscopic approach used without EMG in a limited number of patients.

Since 1996, the senior author (A.M.S.S.) has been endoscopically injecting Botox into the CP muscle without EMG by the technique described. We reviewed our series of 12 patients who underwent 17 injections between 1997 and 2000. Eight of them reported 50% or greater subjective improvement in their swallow function on a quartile scale. Three patients reported only 25% improvement; 2 of them were elderly patients with chronic neurologic disease, and the third had idiopathic CP dysfunction. There was only 1 complication: neck cellulitis associated with a concomitant Sistrunk procedure in an immunocompromised patient.

Postoperative modified barium swallow examination failed to show any significant difference from the preoperative state in 8 of 11 studies. The patients, however, very consistently reported improvement in their swallowing function as starting within 1 week after injection and disappearing 4 to 6 months after injection. This apparent discrepancy may indicate that the modified barium swallow study may not be sensitive enough to determine significant differences in the swallowing function that patients were clearly able to notice. A more quantitative evaluation of swallowing, such as scintigraphy, might have been able to determine postoperative changes. Such an evaluation would allow more objective diagnosis of the swallowing dysfunction before operation, as well. Investigation into this use is under way at our institution.

Evaluation of swallowing symptoms in our patients was performed with a series of questions regarding the tendency of the bolus to become "stuck"
or impeded, and the amount of choking and coughing that takes place with food ingestion. A more extensive, statistically validated questionnaire would be more helpful in evaluating dysphagia patients.

More recently, we have been performing these procedures without an endotracheal tube, using mask ventilation and apneic technique. This practice has further reduced operative time, to less than 10 minutes on average.

CONCLUSIONS
In our series, the safety and viability of endoscopic injection of botulinum toxin in the treatment of dysphagia related to CP muscle dysfunction was examined. Our results suggest that endoscopic Botox injection for the treatment of CP muscle dysphagia was both relatively safe and efficacious in a significant majority of our patients. This relatively simple procedure may be performed with instruments readily available to and techniques well known to most otolaryngologists. Larger, prospective, controlled trials are necessary to establish the effectiveness and role of the endoscopic technique in the management of this condition.

REFERENCES