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Brittani R. Greene

SUNY Plattsburgh, bgree009@plattsburgh.edu

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# Botulinum Toxin Type A Injections into the Cricopharyngeal Muscle to Treat Upper Esophageal Dysfunction



Brittani R. Greene

Department of Communication Sciences and Disorders, Plattsburgh State University of New York

## Research Question

What is the efficacy and duration of an improved swallow due to botulinum toxin injections into the cricopharyngeal muscle?

### Reason for Research

Dysphagia can impact people of all ages because it co-occurs with numerous disorders and health problems. Dysphagia affects over nine million people a year and mainly targeting adults over the age of sixty (Malhi, 2016). There are many compromising health conditions that result from dysphagia and in extreme cases can lead to death (Wilkinson, Picciotto, 1999). It is important to research possible types of effective treatment for dysphagia in order to improve patients quality of life and health.

### Background

The upper esophageal sphincter (UES) is controlled primarily by the Cricopharyngeal muscle. The sphincter acts as a barrier between the pharynx and the esophagus. Temporary opening of UES is normal during some activities such as eating and drinking. When the UES is closed it prevents air, reflux of food, and acidic gastric content from coming up into the pharynx. Proper opening of the UES is dependent on three events: laryngeal elevation, pharyngeal propulsion, and relaxation of the cricopharyngeal (CP) muscle (Kraus, Schirra, Gurkov, 2008). Many causes of cricopharyngeal dysfunction co-occur with dysphagia (Shaw, Searl, 2000). Diagnosis of CP dysfunction are made by different test such as a modified barium study (MBS), manometry, videostroboscopy, and fiberoptic endoscopic evaluation of swallowing (FEES) (Ahsan, Meleca, Dworkin, 2000). This review looks at relaxing the cricopharyngeal muscle to help with upper esophageal dysfunction.

### Summary of studies

Most studies used scales to rate the severity of dysphagia before and after treatment. These scales showed a reduction in penetration and aspiration, an increase in swallow safety, increase in the percent of UES opening, changes in diet, and patient personal ratings. The literature agreed that botulinum toxin injections are a safe and effective treatment that improves swallowing function for most patients. Patients who did not benefit from BtxA may have had other complications, or a possible diffusion of the BtxA into the surrounding muscle. Some literature agreed that subjects who had good outcomes for this treatment would be a good candidate for the permanent surgical treatment (Ahsan et al., 2000; Alberty et al., 2000; Blitzer et al., 1997). Studies showed that botulinum toxin injections are most effective for isolated Cricopharyngeal dysfunction, meaning this is the only cause of their dysphagia. All studies showed that the amount of botulinum toxin injected did not correlate to its duration of effectiveness. Some patients who received less units of BtxA had longer lasting results than those who received more units. This means BtxA cannot be a simple denervation and reinnervation of the muscles (Chiu et al., 2004). Although found to be safe and effective, this is limited due to the need for reinjection and possible diffusion of BtxA into surrounding muscles. Further studies needs to be done on the mechanisms that impact duration. One study suggested possible reasons could be the different injection procedures, the patient's individual response, and the precision of muscle injection (Masiero, Briani, Marchese-Ragona, Giacometti, Costantini, Zaninotto, 2006).

Table 2: Summary of various studies

Study	# of subjects	Mean	Dose	outcome
Shaw et al., (2000)	12	mean= 7.08 months standard deviation= 5.4 months	-Between 25 and 50 units.	-Higher dosage did not relate to longer duration. -Found to be safe and effective. -Most effective in cases of isolated CP dysfunction.
Chiu et al., (2004)	literature review of 28 subjects and one patient of their own	mean= 4.2 months standard deviation= 2.9 months	-Between 30 and 360 units	-Higher dosage did not relate to longer duration. -Efficacy was correlated with duration of efficacy
Murry et al., (2004)	13	mean= 6.5 months	-Between 14 and 120 units	-11 subjects improved after 1st injection -Higher dosage did not relate to longer duration - Found to be safe and effective
Alberty et al. (2000)	10	mean opening of UES before treatment= 47% SD= 14%  mean opening of UES after treatment= 71% SD=24%	-30 units	-These patients all had isolated CP dysfunction -Found to be Safe and effective in most cases but efficacy is limited due to the need for reinjection and possible diffusion into hypo-pharynx

Table 1  
Comparison between amount of Botox injected and duration of effectiveness

Retrieved from:  
Ahsan, S. F., Meleca, R. J., & Dworkin, J. P. (2000). Botulinum toxin injection of the cricopharyngeus muscle for the treatment of dysphagia. *Otolaryngology--Head and Neck Surgery: Official Journal of American Academy of Otolaryngology-Head and Neck Surgery*, 122(5), 691-695. doi: 10.1067/mhn.2000.105997

### Botulinum Toxin and the injection into the CP muscle

Myotomy, a surgical method, was once used as the primary treatment for CPM dysfunction. In 1994, botulinum toxins (BtxA) were introduced as a possible treatment for cricopharyngeal dysphagia (Murray, Wasserman, Carrau, Castillo, 2004). This procedure is done under a general anesthetic and there is no surgery involved (Chiu, Chang, Hsiao, 2004). BtxA is a neurotoxin that inhibits the release of acetylcholine which is a chemical in the body that is released to activate muscles (Kraus et al., 2008). BtxA denervates the muscles and then neuromuscular transmission is usually restored between three and four months (Chiu, Chang, Hsiao, 2004). Denervation of the muscles usually takes about five to six days (Ahsan, Meleca, Dworkin, 2000). There are different types of botulinum toxins as well as different brands. Botulinum toxin type A is used in human movement disorders of the head and neck. The brands of botulinum toxins are Dysport and Botox. Higher doses of Botox are equivalent to lower doses of Dysport (Alberty, Oelerich, Ludwig, Hartmann, Stoll, 2000). BtxA is diluted into .9% saline and injected where the dysfunction is occurring (Chiu et al., 2004).

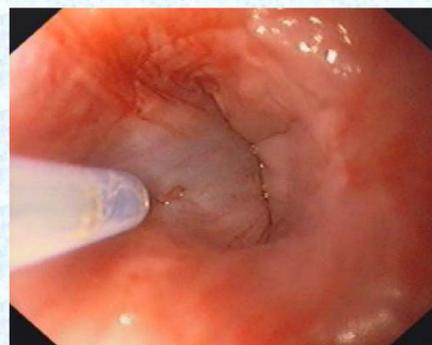


Figure 1. Endoscopic controlled BtxA injection into Cricopharyngeal muscle.  
Retrieved from:  
Krause, E., Schirra, J., & Gürkov, R. (2008). Botulinum toxin a treatment of cricopharyngeal dysphagia after subarachnoid hemorrhage. *Dysphagia*, 23(4), 406-410.  
Retrieved from  
<http://webdb.outside.plattsburgh.edu:2048/login?url=http://search.proquest.com/docview/85401769?accountid=13215>

Table 1

Patient No.	Diagnostic procedures	Diagnostic findings	Amount of Botox injected	Time after previous injection (mo)
1	MBSS	Aspiration, pooled secretions, CP spasm	80 U	—
2	Manometry, videostrobe/FEES	40 mm Hg UES, reflux, CP spasm	1st, 60 U 2nd, 100 U	— 4
3	MBSS, FEES, manometry, videostrobe	Aspiration, pooled secretions, 30 mm Hg UES, delayed CP relaxation	1st, 60 U 2nd, 60 U 3rd, 60 U	— 3 3
4	Videostrobe	Pooled secretions, aspiration, CP spasm	60 U	—
5	FEES, MBSS	Aspiration, pooled secretions, CP spasm	1st, 40 U + ED 2nd, 60 U + ED	— 14

ED, Esophageal dilation.

### Deviations from reviewed literature

Krause, Schirra, Gurkov, 2008

The patient in this study had severe dysphagia due to CP muscle spasms. He received swallowing therapy first which was not effective. Manometry was performed to measure strength and muscle coordination. Manometry combined with a modified barium study diagnosed his CP muscle spasms. He was injected with 180 units of Dysport. The first injection lasted six weeks and the second injection showed almost no improvement in swallowing. The reason was because the BtxA diffused into the pharyngeal muscle. This relaxed the muscle causing food to remain in the pharynx. To avoid anesthesia, he chose application of the BtxA through flexible endoscopy. BtxA is better controlled under rigid endoscopy and the study felt this is why there was a diffusion into the pharyngeal muscle. Overall this study found CP dysphagia is treatable with BtxA, but success is limited in regards to time.

Masiero, Briani, Marchese-Ragona, Giacometti, Costantini, Zaninotto, 2006

Two patients had their swallowing and dysphagia assessed using a scale to measure their penetration-aspiration. Aspiration means the material has passed through the larynx and the vocal folds, and penetration means the material stayed above the vocal folds. Before treatment, one patient scored a seven, and the other scored a six out of eight. This means they both had severe penetration and aspiration. Before the injections rehabilitation with a speech language pathologist (SLP) was done, but there was no improvement. After treatment, both patients obtained a two on the scale which meant there were only signs of penetration not aspiration. Both patients then received rehabilitation with an SLP for 18 sessions lasting one hour, three times a week. Follow up was done at six, 12, and 24 months. Both who were originally on feeding tubes maintained an oral diet. The study felt the long term results were due to a combination of BtxA and rehabilitation. The study also found the duration of the effects were not dose dependent.

### Conclusion

The literature shows BtxA to be a safe and effective method in treating upper esophageal dysfunction, as long as injection is done properly. This treatment works best in isolated cases of CP dysfunction, and may be a good predictor of success with a permanent treatment such as myotomy. More research needs to be done on the effects of duration. Overall dysphagia affects many people due to a numerous of disorders. BtxA can be used as a non permanent but effective treatment to improve the health and quality of life in individuals with UES dysfunction. Further research on the effects of swallowing therapy after botulinum toxin injections should be done, and if positive results are found this could be incorporated into evidence based practice and used by speech pathologists.