International Journal of Physical Medicine & Rehabilitation

OPEN ACCESS Freely available online

Case Report

Exercise Induced Spread of Neurotoxin Following Chemodenervation of Neck Muscles: Report of Four Cases

Ib R. Odderson[1*], James J. Ying[2]

[1]Department of Rehabilitation Medicine, University of Washington, Seattle, WA, USA; [2]Department of Neurosurgery, Swedish Neuroscience Institute, Seattle, WA, USA

ABSTRACT

This is the first study to report that exercise is a risk factor for spread of neurotoxin after cervical chemodenervation. While exercise after limb muscle injection is known to enhance the effects; the effects of exercise following cervical chemodenervation are unknown. We report a case series where exercise following cervical chemodenervation was associated with adverse events or no benefits. The dose ranged from 70-175 units of onabotulinumtoxin A and all injections were performed under EMG guidance. Exercise after chemodenervation was in the form of manual labor such as printing of logos, painting, lifting and cleaning. The events ranged from dysphagia, dysarthria, blurred vision, muscle weakness, heavy head, and numbness, to no benefits. In conclusion, chemodenervation of neck muscles followed by exercise can exacerbate the spread of neurotoxin, limit the therapeutic effect, and cause adverse events.

Keywords: Chemodenervation; Dysphagia; Cervical dystonia; Thoracic outlet syndrome; Exercise; Adverse event; Muscle activation

INTRODUCTION

For cervical muscle injection, there is an absence of after-care guidelines for optimizing the effects of chemodenervation while minimizing adverse events. The effects of exercise, massage, and thermal modalities remain unexplored in the literature. In contrast, when chemodenervation of limb muscles is followed by exercise such as range of motion, stretching, muscle contraction and electric stimulation, there is a beneficial effect in terms of a greater reduction of the compound muscle action potential and reduced muscle tone and improved function [1-4].

We present a series of four cases, where cervical chemodenervation was followed by exercise resulting in unexpected exercise-induced systemic spread, causing dysphagia, dysarthria, blurred vision, weakness, or no benefits.

CASE PRESENTATION

Case 1

A 40-year-old woman underwent her routine 4th chemodenervation for thoracic outlet syndrome. The day after injection her workplace salvaging computers, boxes, and other equipment. The following day she was admitted to the hospital with worsening dysphagia and unable to tolerate solid or liquid textures. On hospital day 2, she failed a bedside swallow test. On day three she was discharged after tolerating a general diet. She still had mild increased work of swallowing 12 days after injection but without signs of aspiration. The chemodenervation was performed under EMG and Ultrasound guidance. She received her usual toxin injection to the left anterior and middle scalenes (25 u each, 100 u/mL), pectoralis minor (50 u, 25 u/ml), levator scapulae (50 u, 50 u/mL), and upper trapezius (25 u, 50 u/mL).

Case 2

A 43-year-old woman with painful cervical dystonia received her 9th injection with a slightly higher dose of onabotulinumtoxin A to her trapezius muscles (70 u, 50 u/ml) under EMG guidance. Following the injection she worked for 6 hours cleaning up the PTA room and lifting boxes. Afterwards she applied a heating pad for more than a couple of hours. In contrast to previous injections she derived no benefits, and had increased pain.

Correspondence to: Ib R. Odderson, Department of Rehabilitation Medicine, University of Washington, Seattle, WA, USA, Tel: 1-2065430119; E-mail: odderson@uw.edu

Received: 07-Feb-2022, Manuscript No. JPMR-22-15756; **Editor assigned:** 09-Feb-2022, PreQC No. JPMR-22-15756 (PQ); **Reviewed:** 23-Feb-2022, QC No. JPMR-22-15756; **Revised:** 25-Feb-2022, Manuscript No. JPMR-22-15756 (R); **Published:** 04-Mar-2022, DOI:10.35248/2329-9096.22.10.623.

Citation: Odderson IR, Ying JJ (2022) Exercise Induced Spread of Neurotoxin Following Chemodenervation of Neck Muscles: Report of Four Cases. Int J Phys Med Rehabil. 10:623.

Case 3

A 33-year-old woman received her first injection under EMG and US guidance for cervical dystonia and thoracic outlet syndrome receiving 240 u onabotulinumtoxinA to her anterior (25 u, 100 u/cc) and middle (25, 100 u/cc) scalene muscles, pectoralis minor (50 u/side, 25 u/ml), semispinalis (25 u, 50 u/cc) and her trapezius (50, 50 u/cc). After chemodenervation she did not minimize her activities, but went to work for more than 4 hours lifting 17-30 lbs ink containers 130 times. She developed blurred vision which lasted a couple of days. No other adverse events (Figure 1).

Case 4

A 62-year-old woman received her first chemodenervation for cervical dystonia with a total of 132.5 u (50 u/cc) of onabotulinumtoxin A to seven cervical muscles (longissimus capitis, levator scapula, posterior scalene, trapezius, and oblique capitis inferior). The day after chemodenervation she did outdoor painting for several hours. The next day, she developed dysarthria and dysphagia, difficulty opening her mouth, heavy head, and numbness in the anterior neck. Three days after injection she also had a massage. She used a cervical collar for two weeks, and felt it took one month to fully recover from her symptoms.

RESULTS AND DISCUSSION

This is the first study to report exercise as risk factor for spread of neurotoxin after chemodenervation of neck muscles. For all cases reported, exercise appears to have been the only factor that increased the spread of the neurotoxin. The first case involved local spread to the pharyngeal constrictor muscles causing dysphagia. Compared to the previous injections there were no changes in dosing per muscle, volumes injected, or muscles targeted. For the third case, injection of the scalene muscle, did not affect her swallowing but produced regional affects with blurred vision. In all cases the toxin doses were well within the normal range for achieving benefits without adverse events.

In limb muscles, chemodenervation followed by muscle activity has generally shown a beneficial effect. Thus, a reduction in amplitude of the Compound Muscle Action Potential (CMAP) was seen after stimulation of the extensor digitorum brevis during the first 24 hours, a reduction of muscle tone and improved function with electric stimulation up to three days, and physical therapy for up to three weeks [1-3]. Also, voluntary exercise in the form of writing for 30 min immediately after injection for writer's cramp resulted in improved writing and reduced muscle strength [4].

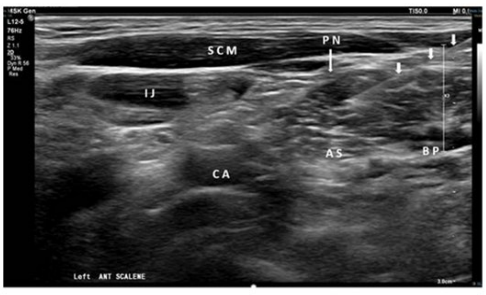

Figure 1: Injection of the left Ant Scalene muscle in Case 3. **Note:** AS: Anterior Scalene muscle, BP: Brachial Plexus, CA: Carotid Artery, IJ: Internal Jugular Vein, PN: Phrenic Nerve, SCM: Sternocleidomastoid Muscle, Short arrows: EMG injection needle.

The mechanism of the spread in our cases is likely due to increased muscle activation that enhanced the exodus of the toxin. Since neurotoxin easily passes through the muscle fascia, and the anterior scalene muscle is in close proximity to the pharyngeal constrictors, the toxin can easily spread by diffusion as in the first case [5,6]. For the other cases the adverse effects were more likely from regional hematogenous spread.

CONCLUSION

To limit spread of the toxin, muscle activation should be minimized for the first few days after injection. In addition, by minimizing the volume injected and combining US and EMG guidance so the belly of the muscle can be injected, may also reduce the spread. Furthermore, avoiding heat and massage is recommended for a couple of days. In conclusion, chemodenervation of neck muscles followed by exercise can exacerbate the spread of neurotoxin, limit the therapeutic effect, and cause adverse events.

FUNDING

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

ACKNOWLEDGEMENTS

The work described has not been published previously. It is not under consideration for publication elsewhere, its publication is approved by all authors and tacitly or explicitly by the responsible authorities where the work was carried out, and, if accepted, it will not be published elsewhere in the same form, in English or in any other language, including electronically without the written consent of the copyright-holder.

REFERENCES

1. Eleopra R, Tugnoli V, de Grandis D. The variability in the clinical effect induced by botulinum toxin type A: the role of muscle activity in humans. Mov Disord. 1997;12(1):89-94.
2. Hesse S, Jahnke MT, Luecke D, Mauritz KH. Short-term electrical stimulation enhances the effectiveness of Botulinum toxin in the treatment of lower limb spasticity in hemiparetic patients. Neurosci Lett. 1995;201(1):37-40.
3. Giovannelli M, Borriello G, Castri P, Prosperini L, Pozzilli C. Early physiotherapy after injection of botulinum toxin increases the beneficial effects on spasticity in patients with multiple sclerosis. Clin Rehabil. 2007;21(4):331-7.
4. Chen R, Karp BI, Goldstein SR, Bara-Jimenez W, Yaseen Z, Hallett M. Effect of muscle activity immediately after botulinum toxin injection for writer's cramp. Mov Disord. 1999;14(2):307-12.
5. Shaari CM, George E, Wu BL, Biller HF, Sanders I. Quantifying the spread of botulinum toxin through muscle fascia. Laryngoscope. 1991;101(9):960-4.
6. Castelao M, Marques RE, Duarte GS, Rodrigues FB, Ferreira J, Sampaio C, et al. Botulinum toxin type A therapy for cervical dystonia. Cochrane Database Syst Rev. 2017(12).