Neurolytic Injection of Botulinum Toxin Type A and Phenol for Spasticity a Patient with Traumatic Brain Injury

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Abstract

Objective
To evaluate the effects of Botulinum Toxin Type A (BTX-A) and 7% Phenol injection in the management of spasticity in a patient with traumatic brain injury at the University Hospital of the West Indies (UHWI).

Method
This is a case report of a patient treated at the Physiatry clinic at UHWI and who had Physiotherapy/Occupational therapy at UHWI and Sir John Golding Rehabilitation Center. The patient was functional only at a wheelchair level and had increased flexion at the right elbow and wrist. He received BTX-A injection to his right elbow flexors and wrist flexors. He continued therapy and was seen for follow up at six (6) weeks, ten (10) weeks and then seven (7) months after the BTX-A injection. He therefer received 7% phenol to the right flexor carpi radialis. Any change in range of motion (ROM) of the joints was measured using a goniometer and spasticity was assessed using the Modified Ashworth Scale (MAS).

Results
The patient had improvement in the ROM with right elbow extension from 130° to 160° at six (6) weeks, then to 170° at ten (10) weeks however at seven (7) months the ROM decreased to 130° despite continuing therapy. He was treated with 7% phenol injection to his right flexor carpi radialis and had improvement in ROM of elbow extension to 165°. Wrist extension range of motion improved from -10° to neutral at six (6) weeks and then to 10° at ten (10) weeks but then decreased to -5° at seven (7) months, but overall showed a +5° improvement. Additionally, he had Berg Balance improvement from 3 to 15 and Barthel Index from 13 to 72, and subsequently was able to walk using a roll walker, with assistance, for the first time after his injury.

Conclusion
Botulinum Toxin Type A and 7% phenol were effective in treating this patient with spasticity secondary to traumatic brain injury.

Keywords: Botulinum Toxin Type A, 7% Phenol Injection, Spasticity, Traumatic Brain Injury, Physical Medicine & Rehabilitation

Introduction
Spasticity is a known complication in traumatic brain injury (TBI) and is seen where there is abnormal motor control due to upper motor neuron lesions[1]. Spasticity is a motor disorder characterized by velocity dependent increase in muscle tone, with enhanced stretched reflexes and exaggerated tendon jerks, one component of upper motor neuron syndrome[2]. In TBI there is disruption in brain function which may result in the loss of descending inhibition in the corticospinal tracts, which leads to alpha motor neurons excitability[3,4]. Head injuries are not uncommon and account for 13.6% of all trauma cases seen in the emergency department at the University Hospital of the West Indies, of that amount 2% underwent craniotomy during 2001-2005[5]. The UHWI Trauma Registry, which is administered and maintained by the Department of Surgery, Radiology, Anesthesia and Intensive Care, indicated that in 2011, brain injuries accounted for 19% of all trauma cases admitted to the UHWI. The incidence and prevalence of spasticity in Jamaica is unknown, however, it is believed that 20% of stroke patients and 75% of patients with severe brain injury may develop spasticity according to a consensus of experts in Britain[1,6]. The severity of spasticity varies from mild, moderate or severe muscle stiffness to uncontrolled muscle spasms with pain. Severe spasticity can significantly inhibit one's activities of daily living and function. Patients that have had TBI are at risk
of developing spasticity that may lead to crippling disability if left untreated. As such, early rehabilitation intervention should be started and has been proven to enhance functional outcome in brain injury survivors[7]. Outcome measures commonly used to assess spasticity include the Modified Ashworth scale (MAS) and Tardieu scale, which grade the resistance to velocity dependent passive stretching. The Berg Balance is a valid scale used measure balance in individuals with impairment in balance function[8]. Traumatic brain injury patients commonly have multiple medical and rehabilitation needs and as such a multidisciplinary team approach should be incorporated including: physiotherapist, occupational therapist, speech and language therapist, neuropsychologist, nurses, and doctors. Treatment begins with education of the patients and their caregivers on management of all the areas of needs and in particular for spasticity the methods of stretching and positioning. The medical management for spasticity may incorporate therapy and bracing, medications such muscle relaxants medications (eg. Baclofen), neurolytic injection (Botulinum Toxin Type A and 7% Phenol), intrathecal Baclofen pump, and in severe cases, surgery may be necessary.

Case Report

The patient is a 20-year old male, diagnosed with severe traumatic brain injury from head injuries sustained from an assault. He was admitted to the UHWI emergency room and was noted to have decerebrate posturing. He underwent emergency neurosurgical intervention for intracranial hemorrhage and was subsequently hospitalized for approximately six (6) months during which time physiotherapy was started. He was seen in the Physical Medicine and Rehabilitation (PMR) clinic fifteen (15) months post injury, and complained of not being able to walk or use his right upper extremity. He was also noted to have cognitive impairment and dysarthria. On initial examination, he was able to stand with maximum assistance of two (2) persons and had great difficulty making a single step. He was found to have tetraplegia with spasticity, both upper extremities were evaluated and graded Modified Ashworth Scale (MAS) 3 throughout and both lower extremities were MAS 2 throughout. He also had decreased range of motion in all limbs especially in the right upper extremity where he could only attain shoulder abduction to 95°, elbow extension 130° and wrist extension severely limited to -10°, the latter making it difficult to position his right hand and arm to grip a walker for him to support himself to stand. He was started on baclofen 10mg orally three times per day and received BTX-A 200 units to his right elbow flexors (biceps and brachioradialis) and finger flexors (flexor digitorium muscles) and he had serial casting for his right wrist for sustained stretching which was replaced every one (1) to two (2) weeks and was managed by a rehabilitation team which included a Physiatrist, Physiotherapist, Occupational Therapist and Psychologist. At one month follow up he was able to stand and walk using a roll walker with minimal assistance. He had improvement in Berg Balance Scale from 3 to 15 and improved function evaluated by Barthel Index which increased from a 13 to 72. Overall, spasticity improved from MAS 2 to 1+ in lower extremities and from 3 to 1+ and 2, with the most improvement in his upper extremities. Prior to BTX-A injection the patient was noted to have right elbow extension of 130°, this improved to 160° at six (6) weeks, then to 170° at ten (10) weeks, however at seven (7) months the ROM decreased again to 130° despite continuing therapy and compliance with home exercise. He was treated with 7% phenol injection to his right flexor carpi radialis and had improvement in ROM of elbow extension to 165°. He was not able to have repeat BTX-A due to the limitation of cost. Wrist extension range of motion improved from -10° to neutral at six (6) and ten (10) weeks but then decreased to -5° at seven (7) months, but overall showed a +5° improvement. He was seen for follow up at six (6) weeks after phenol and the last visit one and a half year after phenol, he still maintained right elbow extension of 165° and was still compliant with home exercise. He was then able to walk with minimal assistance using a roll walker and he was able to position his right hand and arm to grip the handle of a roll walker. He reported that his favorite hobby was “walking”.

Discussion

Spasticity is a motor disorder characterized by velocity-dependent increase in tonic stretch reflexes with exaggerated tendon jerks, resulting from hyperexcitability of the stretch reflex[7,9]. Traumatic brain injury is a known neurological disorder that can lead to spasticity[10]. The true incidence of spasticity is not fully known but it affects approximately 1.7 million people in the United States and over 12 million worldwide[11]. If left untreated spasticity can result in discomfort, constant pain and may eventually negatively impact

**Figure 1a:** Patient displaying extension and flexion stretch exercises in left arm with right arm in serial cast.

**Figure 1b:** Patient walking for first time in therapy.

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one’s activities of daily living[12]. In 1989 Das and Park reported the first use of BTX-A to treat spasticity [13]. The mechanism of action of BTX-A is by controlling the excitatory motor neurons by blocking the release of Acetylcholine at the neuromuscular junction. The effects of BTX-A can last for 8-16 weeks. This is evident in this patient where he had a 35° improvement in ROM with right elbow extension within eight (8) weeks after BTX-A injection. The other neurolytic injectable medication used is Phenol, which is an alcohol, and in concentrations of greater than 3% causes longer neurolysis by denaturing peripheral nerves myelin [14]. BTX-A and Phenol are adjuvant treatment used with muscle relaxants (e.g. baclofen), therapy, bracing, orthotics and in some cases surgery. In this case report the patient had increased range of motion, improved spasticity and improved function after neurolytic injection with BTX-A and/or Phenol. It must be emphasized that improvement in spasticity and range of motion after neurolytic injection is best seen when there is therapy and patients are compliant with home exercise for stretching and range of motion. The patient in this case report was compliant with therapy and home exercise program of stretching and strengthening. BTX-A injection 6-8 weeks and could have been repeated but due to the cost was prohibitive as such phenol was used. The use of BTX-A and phenol injection to treat spasticity secondary to traumatic brain injury has never been done in Jamaica nor the Caribbean to our knowledge.

Our case report concurs with other studies that show the effective use of BTX-A and Phenol in improving spasticity, range of motion and motor function [15,16]. There were no complications or reported side effects associated with the use of BTX-A and Phenol in these cases, however in reviewing the literature there have been reports of local bruising, pain and swelling at injection site [17].

References