



Bell's Palsy's Viral Pathogenicity and The Use of Botulinum Toxin Type A As Treatment

Bell Felcinin Viral Patojenitesi ve Tedavi Olarak Botulinum Toksin Tip A Kullanımı

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Abstract

Bell's palsy is the common name for the inflammation of the cranial nerve VII. The peculiar geniculate ganglion inflammation is idiopathic and causes hemifacial paralysis. Patients who suffer from this paralysis may have their symptoms dissipate between 3 weeks and 3 months. For certain patients whose facial paralysis persist, botulinum toxin type- A might be an efficient treatment. Depending on the severity of the muscular palsy, different treatments can be offered including surgery, steroid, and anti-viral treatment as well as Botox. This review article's purpose is to dive into the possible correlation of viral pathogens with the activation of the facial nerve inflammation, and how patients with Bell's palsy can benefit from Botox type-A as treatment.

Keywords: Bell's palsy, botulinum toxin type A, Botox, facial nerve, muscular paralysis

INTRODUCTION

Bell's palsy is a disturbance of the unilateral peripheral facial nerve, also called cranial nerve number VII. Bell's palsy is commonly interchanged with the term "peripheral facial paralysis." It is one of the most typical malfunctions of the facial nerve. About 60 – 75% of the cases are considered idiopathic.^[1] Bell's palsy affects approximately 11.5 – 53.3 per 100,000 people across several populations,^[2-5] and it usually presents as a subtle unilateral frailty of the facial muscles, significantly reducing the quality of life. Fortunately, the paralysis experienced by patients suffering from this disease is mostly temporary. Seventy percent of patients report the facial weakness going away within 6 months, with only a few cases requiring antiviral

Öz

Bell'in felci, kraniyal sinir VII'nin iltihaplanmasının ortak adıdır. Kendine özgü genikulat ganglion iltihabı idiyoPATİktir ve hemifasiyal felce neden olur. Bu felçten muzdarip olan hastaların semptomları 3 hafta ile 3 ay arasında kaybolabilir. Yüz felci devam eden bazı hastalar için botulinum toksin tip A etkili bir tedavi olabilir. Kas felcinin şiddetine göre botoksun yanı sıra ameliyat, steroid ve antiviral tedavi gibi farklı tedaviler sunulabilir. Bu derleme makalesinin amacı, viral patojenlerin fasiyal sinir iltihabının aktivasyonu ile olası ilişkisine ve Bell felçli hastaların tedavi olarak botoks tip-A'dan nasıl yararlanabileceğine dalmaktır.

Anahtar Kelimeler: Bell paralizi, botulinum toksin tip A, botoks, fasiyal sinir, kas felci

treatment, steroid treatment, or surgery. Even when Bell's palsy goes untreated, eighty five percent of the patients will at least experience mild to moderate recovery within three weeks of its onset presentation.

Bell's palsy is well known as an inflammation of the geniculate ganglion of the facial nerve, which causes muscular paralysis via demyelination and possible ischemia. The symptoms experienced by patients who suffer unilateral facial paralysis usually peak in a about a week and slowly resolve between three weeks and three months. Bell's Palsy is most seen in diabetic patients and has been reported in patients of a broad range of ages, however incidence is higher after forty years of age



regardless of gender. The cranial nerve seven, responsible for the locomotion of the facial muscles, lies in the facial canal in between the tympanic segments where it takes a turn down the stylomastoid foramen. The inflammation of this nerve is proven to cause facial paralysis however, several types of viral infections like human immunodeficiency virus, herpes zoster virus, Hepatitis B, and Epstein Barr virus have been associated with the occurrence of Bell's palsy.^[4] Studies have failed to isolate viral DNA causative role. Therefore, whether viruses are the underlying cause of the inflammation reaction in Bell's palsy remains uncertain.

This article serves to provide a comprehensive analysis on the efficacy of botulinum toxin type-A as a treatment for Bell's palsy on multiple evidence-based clinical cases. The main mechanism for BtA treatment of peripheral facial paralysis is through the intramuscular injection of toxins that cause cholinergic inhibition. Although Bell's palsy is considered an idiopathic disease, this article focuses on the correlations of viruses as potential activators of the initial appearance of the inflamed geniculate ganglion and secondary symptoms. This research aims to bring awareness of the pathogenicity of Bell's palsy and its serological, anatomical, and psychological counterparts. Therefore, the purpose of this review is insight into the possible correlation of viral pathogens with the activation of the facial nerve inflammation, and how patients with Bell's palsy can benefit from early detection of Bell's palsy. Early detection is crucial for better treatment of the disease and to greatly ameliorate the uncomfortable weakness of the facial muscle. As hypothesized by the studies of the authors in this review, the research also aims to find an improvement in the muscle paralysis created by the cranial nerve seven and an overall improvement of the disfigurement of the patients faces after being managed with botulinum toxin type A.

Diagnostic Criteria Utilized for Identification of Bell's Palsy Symptoms

The primary indicator of peripheral facial paralysis is the temporary loss of unilateral motor function on the face causing asymmetry. The unilateral muscle weakness presented is usually detected by the patient when looking into a reflector or by a relative. Secondary indicators of Bell's palsy are a lopsided smile, drooping mouth corner, flattening of lip fold, and widening of the eyelid opening.^[6,7] These are all common symptoms shown in patients with facial paralysis. Recent research suggests that eyelid closure is an important criterion to identify the degree of severity. It is widely believed that the symptoms of Bell's palsy are triggered by the inflammation of muscles originally caused by viruses. In addition to the previous list of viruses associated with peripheral facial paralysis, studies have been also testing for mononucleosis, shingles, and cold sores in patients that suffer Bell's palsy, as they can all trigger the swelling around the cranial nerve seven.^[8]

Several different scales are used to identify and diagnose the severity of Bell's palsy, including the Stennert Index, the Sunnybrook scale, TETRAS, and the six-point House and Brackman scale (Grades I – VI).^[9] The House-Brackmann is the most common for clinical use in America; however, the other scales are still used in Europe and for specific types of clinical measures. The House-Brackmann scale identifies grade I as regular nervous function and grade VI as complete facial paresis. Grades II and III are mild to moderate with reduced to barely possible forehead innervation and lid closure being still barely possible with reduced mouth innervation. Grades IV and V are moderately severe to severe asymmetry and incomplete lid closure. Grade VI is complete paralysis and total loss of tone; with no mouth, eyelid, or forehead innervation.^[1]

Correlation Between Viruses and Peripheral Facial Paralysis

The root cause of facial palsy is not yet understood in its entirety, and the methods of treatment are complicated. The muscle weakness present in Bell's palsy seems to be reaction to a viral infection causing inflammation and swelling around the nerve that controls the muscles of one side of the face. Bell's palsy has been reported on several studies between ages of 15 and 60 and scarcely ever reoccurs. The Guideline Development Group has been able to identify the acute nature of facial paralysis arrives at its maximum intensity within 72 hours of onset paresis^[6], which is key in identifying the best treatment plan. Numerous studies done have provided significant data to correlate viruses and Bell's palsy. A recent study used polymerase chain reaction to sample viral factors in bodily fluids of patients with Bell's palsy. During the study, the research team was able to detect that 71% of the 42 patients tested positive for HHV-6 (Human Herpes Virus). The team concluded that there is a possible correlation in viral material causing the paralysis.^[10,11]

Another study in the emergency department of the Charité, Universitätsmedizin Berlin, correlates the inflammation of the geniculate ganglion with viruses. Data was collected and analyzed from 2010 to 2017 where cold viruses triggered the unilateral facial paralysis.^[12] After identifying the main ICD-10 hospital diagnosis, the patients were sent to neurology to exclude other symptomatic problems like headache, cranial neuropathies, and severe ear pain. Isolating Bell's palsy specific cases was done so that no other neurological factor would taint the experiment's data. The results concluded that seasonal acute respiratory infections may be a strong candidate for the pathogenicity of facial palsy due to its ability to reactivate the herpes zoster virus (latent).

Botulinum Type A as Treatment for Bell's Palsy

Botulinum toxin was discovered to have a purpose for treating hyperactive motor nerve filaments since 1954 in Brooks VB publication,^[13] and theorized since as early as

1822, when Justinus Wurst Kerner,^[14] extracted the microbial toxin from a spoiled sausage and observed an interference with muscle nerve transmission. It has been approximately twenty years since the FDA approved the management of botulinum toxin type A for treatment of many neurological diseases. Botulinum toxin works on the muscle by inhibiting its motor cholinergic neurons. A cholinergic neuron is essentially a nerve cell whose function is to release the neurotransmitter acetylcholine, which causes the muscular contraction.^[15] In essence, botulinum toxin inhibits the muscles by occluding the exocytosis of acetylcholine that is contained in the vesicles at the neuromuscular junction. This same neuromuscular mechanism is applied when using BTX-A on paralysis of nasolabial fold, buccinator, frontalis, orbicularis oculi, and other muscles innervated by cranial nerve VII.

The results of BTX-A treatment for peripheral facial paralysis have shown to be favorable. Much research suggests the use of the specific Botox “BTX-A” has had better outcomes in treating peripheral facial paralysis.^[16] According to the research data collected by Zhang and Pendolino, the treatment of BTX-A on Bell’s palsy is efficient, and patients who underwent this treatment reported an improved quality of life. A study by Dr. Kim et. al, measured the menton deviation and volume of the masseter muscles in 16 patients suffering from peripheral nerve paralysis before and after treatment of the BtA injection and found significant improvement in the bulkiness and height of the injected site of the asymmetry. Some patients with menton deviation who had over 3 mm deviations had reductions, but patients without menton deviations had greater and more significant reduction in volume and bulk height in their facial muscle (masseter m.). Depending on the case, one or more active treatments could be necessary to treat the specific bilateral or hemi facial paralysis. For the most part, botulinum toxin type A, has proven to be extremely effective and has shown to improve the mobility of the facial muscles, as well as the overall lifestyle of many patients.^[17] Dr. A. Sahan, who treats unilateral facial nerve paralysis even when prior blepharoplasties or other cosmetic surgeries have been done, had similar success rates with BTX-A. 6.5 units of botulinum toxin A, intramuscularly seems to be the typical dosage as correction to minor asymmetries on the face.^[18] The study done by Dr. G. Duarte also supports the improvement of blepharospasms by treatment with botulinum toxin type A. BtA showed moderate to large improvement with a reduced 0.93 in the Jankovic Scale.^[19] Yet another study of BtA treatment in 92 patients showed a good response in 96% of them showing the common trend that prolonged treatment of BtA is safe and effective.^[20]

The Different Derivatives of Botulinum Toxin Proteins

C. botulinum is an anaerobic, gram-positive, and rod-shaped bacteria. There are many different types of proteins derived from the bacteria *Clostridium botulinum*,

botulinum toxin type-A being a derived protein, commonly known as “Botox”. Some of the other derived proteins have limited effectiveness. There are eight distinguishable toxins at the antigen level: botulinum toxins A, B, Ci, Cii, D, E, F, and G. Excluding Botulinum toxin A. Even though they all block the acetylcholine release, they are not as common and are not heavily utilized in clinical neurology because of their lower efficacy.^[21] Because botulinum toxins serotypes do not have the same receptor, they act differently within the cell—hence the difference in potency and duration. The most recommended for patients with bell’s palsy, focal dystonia or synkinesis is botulinum toxin type A which has lasting effects of three months. Its use has gained such success that it is considered a concomitant treatment for peripheral facial paralysis.^[22]

Research is ongoing as to how and if the rest of the serological specimens of botulinum have other useful purposes besides inhibiting the exocytosis of acetylcholine. An interesting finding in a study published in The international journal of food and microbiology, found that nitrogen seems to inhibit the growth of clostridium bacteria. The nitrogenous agent did not only hamper the bacterial growth of all clostridium bacteria, but it stunted the toxicity of botulinum toxin type B.^[23] However, botulinum toxin type A is preferred over its seemingly homologous antigenic counterparts when treating Bell’s palsy because of its stability even after being purified. When these toxins are purified, they become unstable and decrease their biological ability to inhibit muscle contraction.

Evaluation of Risks of Treating Peripheral Facial Paralysis with Botulinum Toxins

Treatment risks from BtA injections are low to moderate when it comes to its intermuscular injections on facial muscles. Risks and complications are higher in surgical intervention in treatment of Bell’s palsy. Invasive surgical procedures tend to be naturally of greater risk and longer recovery times. As a general precaution it is recommended for patients that receive botulinum toxins treatment to rest for a few days before exercising, getting facials or facial massages, going to laser treatment or IPLs. This recommendation is made to try and avoid the toxins from dislodging and getting absorbed at the wrong areas in the face. From a general point of view, regardless of the etiology or the length of treatment of BtA, it is considered effective and safe to use in facial nerve disorders specifically in hemifacial spasms.^[20]

Follow up treatment is usually required for most chronic cases of peripheral facial paralysis. The administration of botulinum toxin A usually requires injections with intervals of 3 months for its desirable effect. However, the intervals and the dosage vary highly depending on the assessment and severity of the disease. The response to the injections should be assessed by the patient and healthcare provider to resolve the paralysis and of course for pain management

reasons. Patients who receive multiple injections within the three-month periods over the years risk the development of toxin tolerance, specifically the patients who received higher than normal dosage. The way the patient does this is by making antibodies for the toxins, often requiring switching to the other serological versions, for example botulinum type B, F and C. For this reason, it is ultimately recommended to take the lowest effective dosage and as less frequently as possible.^[21]

Improvement of Quality of Life After Botulinum Toxin Treatment

Bell's palsy can cause physiological problems for many patients depending on how severe the paralysis is, but Bell's palsy can also cause severe psychological stress in patients, hindering their social interactions and causing social withdrawal. A Pearson correlation analysis demonstrated that psychological factors such as tension, vigilance, openness to change and warmth were different in patients suffering from Bell's palsy compared to healthy patients.^[24] There was another study where a positive correlation was found between moderate depression and the length of on-set peripheral facial palsy.^[25] Furthermore, another clinical experiment made by Dr. Mehta was done in efforts to measure the improvement in patients with facial paralysis after the administration of BtA injections. The study was held at an outpatient clinic that treats facial nerve paralysis and suggested that the general use of botulinum toxin type A has a stable benefit in controlling facial nerve palsies and has a statistically significant improvements in the quality of life.^[26]

Peripheral facial paralysis can be pernicious to patients who suffer the condition. A psychological study performed by S. Pouwels et. al. involved 59 patients, 62% of whom were female patients and 38% of whom were male. The aim of the study was to gain understanding on how age and the severity of Bell's palsy would affect the psychological factors on the different patients. The overall population that was above 55 years of age was associated with moderate depression, linking depression with the severity of the disease by applying the Hospital Anxiety and Depression Scale (HADS).^[25] 50.8% of the patients reported scoring between 11 and 15 on the HADS scale who had paralysis for less than 5 years. In a more comprehensive study, 6 studies were scrutinized in a reviewed by Dr. J. Fuzi, and ultimately found that there is a positive trend in the improvement of facial paresis through the administration of botulinum toxin type A.^[27]

Concluding Remarks

As hypothesized, the administration of botulinum toxin type A proved to be efficient and showed major improvements in the mobility of facial muscles of patients suffering from Bell's palsy. In cases of toxin resistance to BtA, botulinum toxin types B, C, and F can also be administered to treat peripheral nerve palsies. Defining the correlation of the reactivation of certain viral diseases or cell mediated inflammatory responses and

facial palsy seems to be necessary to further understand how and why it sparks an inflammation on the facial nerve and consequently cause the popular paralysis. However, there is highly suggestive evidence that viral infections could be contributing to the inflammation of the geniculate ganglion. More research is required on the concomitant treatment of onset peripheral facial paralysis with steroids, antivirals, laser treatment, and physical therapy with botulinum toxin injections. Patients who were experiencing depression as a consequence of Bell's palsy, reported regaining confidence in their social interactions and having big improvements in their quality of life. Botulinum toxin type A has the longest effect on muscle tissue compared to its serological types and it is the most well-regulated serotype for treatment of Bell's Palsy.

ETHICAL DECLARATIONS

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