

Radiation Exposure and Bell's Palsy: A Hypothetical Association

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ABSTRACT

Bell's palsy is an idiopathic peripheral nerve palsy involving the facial nerve. It accounts for 60 to 75% of all cases of unilateral facial paralysis. The main mechanisms to induce BP remain unclear, but infection, ischemic condition and immunodeficiency may contribute to the development of Bell's palsy. Accumulating evidence has shown several factors can trigger the reactivation of latent HSV including psychological stressors, physical stressors and immunosuppression. Ionization and non-ionization radiations are of importance of physical stressors. Some data have shown radiation can reactivate HSVs. Based on preliminary studies showing radiation reactivation of HSVs, we aimed to hypothesize radiation (in both forms of ionization and non-ionization) may cause Bell's palsy. In the future, the role of radiotherapy, radiofrequency radiation from mobile phones and wireless devices in HSV reactivation and Bell's palsy should be investigated.

Keywords

Radiation, Mobile Phone, Herpes Virus, Bell's Palsy, Hypothesis

Introduction

Bell's palsy (BP) is a common idiopathic neurologic disorder which involves facial nerve and leads to peripheral nerve palsy. Based on previous studies, BP accounts for approximately 60–75% cases of unilateral facial paralysis [1]. The annual incidence is 15 to 30 cases per 100,000 people [2]. The main mechanisms to induce BP remain unclear, but infection, ischemic condition and immunodeficiency may contribute to the development of Bell's palsy [3]. As an interesting mechanism suggested by McCormick, reactivation of herpes simplex virus (HSV-1) is a possible cause of BP [4]. Accumulating evidenceshows several factors can trigger the reactivation of latent HSV including psychological stressors, physical stressors and immunosuppression. Ionization and non-ionization radiations are of importance of physical stressors. Several studies have revealed that radiation can reactivate HSVs [5].

Riel-Romero et al. observed cranial irradiation might reactivate latent herpes simplex virus. They reported this finding from a 15-year-old male with a brainstem glioma treated with Temozolomide and conventional radiotherapy [6]. In a similar observation, Tohyama et al. reported HSV was reactivated in a 5-year-old male with a pontine glioma, two weeks after completing radiotherapy [7]. The reactivation of HSV in these studies has begun from early days to months after radiotherapy.

Epstein et al. reported that just 3.6% of the head and neck radiotherapy

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patients were positive for HSV during radiation therapy [8].

Shimeld et al. demonstrated that ultraviolet radiation could induce the reactivation of herpes simplex virus type 1 in the corneas of latently infected mice [9]. In an experimental study, Perna et al. showed that ultraviolet light could reactivate herpes simplex virus in over 60% of all attempts [10]. Rooney et al. reported UVB light is a potent stimulus for inducing reactivation of latent herpes simplex virus (HSV) infections [11].

In a recent study, Yang et al. showed induction of Epstein-Barr virus early antigen expression in Raji cells by GSM mobile phone radiation; meaning that radiofrequency radiation may reactivate herpes simplex virus [12].

Hypothesis

Based on preliminary studies showing radiation reactivation of HSVs, we aimed to hypothesize radiation (in both forms of ionization and non-ionization) may cause Bell's palsy.

Evaluation of Hypothesis

With unknown cause, BP is a rapid facial nerve paralysis which serves as the most common neurological disorders. As an accepted pathway, the reactivation of latent HSVs using stressors can lead to BP. In the present study, we hypothesized radiation as HSV activator may lead to BP. Although, little evidence has been found associating radiation (ionization and non-ionization) and HSVs reactivation, but scientific evidence shows this fact, practically and theoretically. On the other hand, cancer statistics show head and neck cancers are common cases of cancer in developed countries [13] and as a main treatment approach, these patients receive radiotherapy in their course of treatment. In this light, the incidence probability of BP may rise due to radiotherapy-induced HSV reactivation. As a similar phenomenon, there are studies revealing radiotherapy hepatitis B virus reactivations in

hepatocellular carcinoma [14-16].

As an important health concern, non-ionization radiofrequency radiation such as mobile phones, wireless and Wi-Fi are increasing in workplaces, homes and public places and remain as the newest environment pollutants [17-18]. In this era, this concerning situation may also be risen when these radiations have potential to reactivate HSVs and induce Bell's palsy, particularly mobile phones that are used near the head.

An experiment that would help establish the groundwork for testing the hypothesis would be to expose mice head and necks to radiation followed by an examination of the reactivation of HSVs and BP manifestation.

Further investigation and new experiments in vivo are needed to determine whether radiation exposure particularly in head and neck regions is causing the reactivation of HSVs that would result in BP.

Conclusion

Radiation-induced Bell's palsy has been hypothesized in the present paper. However, we believe that it can be modelled and studied as a new radiation induced health consequence in radiotherapy cancer patients and also all public which use mobile phones or have been exposed to UV radiation. In the future, the role of radiofrequency radiation from mobile phones and wireless devices in HSV reactivation and Bell's palsy should be investigated.

Conflict of Interest

None

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