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Electric and Magnetic Field Applications as Alternative or Supportive Therapy for Covid-19

Zaka Abbaszade[1*], Gozde Turkoz Bakirci[2] and Morteza Haghi[2]

[1]Department of Medical Biology, Ege University, Bornova/İzmir, Turkey

[2]EDGE Food and Feed Analysis Laboratory, Izmir, Turkey

*Corresponding author: Abbaszade Z

Department of Medical Biology, Faculty of Medicine, Ege University, Bornova/İzmir, Turkey.

zekaabbaszadeh@gmail.com

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Abstract

Magnetic field, electric field and electric current are part of nature. Therefore, living organisms, likewise viruses, can be affected by physical processes. Therapeutic and supportive effects of electric and magnetic fields are proved in numerous studies on cells, bacteria and viruses. In our review, by keeping in mind this potential, we handled the possible curative or supportive and maybe therapeutic potential of electric and magnetic applications on coronavirus patients as short as possible. Studies have given us an idea to review new application methods using electric and magnetic field for coronavirus treatment. While vaccine and drug studies related to this pandemic continue, alternative therapies are also of great importance and new approaches and different perspectives are needed in this regard.

Keywords: Magnetic field; Electric field; SARS-CoV-2; Coronavirus; Pandemic

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Introduction

Covid-19 was firstly reported in China by Chinese Center for Disease Control and Prevention in 2019 as a new contagious virus [1]. Following that on 11 May 2020 World Health Organization (WHO) identified this virus disease as pandemic [2]. Six human coronavirus species exist. They are SARS-CoV, MERS-CoV, HCoV-NL63, HCoV-229E, HCoV-OC43 and HKU1. Two of them (SARS-CoV and MERS-CoV) are more pathogenic and had potential to establish high level of damage on respiratory systems [3,4]. Coronaviruses are single stranded RNA viruses. First found in 1966 by Tyrrell and Bynoe. Between 425 patients that found out, which 56% of them was male, median ages of patients with high morbidity and high death rate was 59 [5]. Four subfamilies exist.

Coronavirus genome consists of ~30000 nucleotides and encodes 4 crucial proteins for the virus. These are Nucleocapsid (N) protein, Envelop (E) protein, Membrane (M) protein and Spike (S) proteins [6]. This epidemic, which is spreading rapidly, requires the development of fast and effective treatment methods that are both virus-focused, stimulating and helpful.

Effects of Magnetic Field on Living Organisms and Viruses

Magnetic field expresses a force that can be generated by moving electrons. It can be detected and measured by coils system sensitive to magnetic field. Magnetic field can be applied by using permanent magnets or electromagnets, which is generated by electric current. Numerous studies have proven that the magnetic field has significant effects on organisms and organic molecules. Therefore, the effects of the magnetic field on cancer cells are remarkable and of great importance [7,8]. According to results of a study Mirtskhulava et al. [9]. the H1N1 influenza infected and mice which exposed to Pulsed Electromagnetic Field (PEMF) shown to be affected by PEMF and the more field affect more viruses. Therefore, the PEMF treatment shown to be raised its resistance to immune system by boosting ATP production [10]. Besides, several studies magnetic field applied with magnetic nanoparticles (NPs) and tweezers was also effective against coronavirus family species. For instance gradient magnetic field applied to SARS-CoV-2 can affect RNA orientation and membrane potential through M protein [11]. Therefore, PEG-modified ferrite NPs, can go into lung cells *via* phagocytosis, may bind to RBD of SARS-CoV-2 [12].

Another therapeutic effect of magnetic field is its significant impact on blood circulation, which helps immune agents and cells to act faster. According to 70 mT magnetic field increased blood flow on rats [13]. Static magnetic field has also anti-inflammatory effect through altering some immune mediators such as cytokines and interleukin [14].

Effects of Electric Field and Electric Current on Living Organisms and Viruses

Electric field is field that exists around electrically charged particules or objects. With the help of driving force of electric field, electrons flow through conductive materials and creates electric current. The electric field can also be generated in different ways. Electric current affects organisms at cellular and molecular levels. Numerous studies approved that direct and pulsed electric current, with various waveforms, has different effects on cells. For instance, cells exposed to pulsed electric field with nanosecond delays and membrane pores are formed [15]. Therefore, signaling pathways were also shown to be affected by Nanosecond Pulsed Electric Fields (nsPEFs) [16-18]. Viruses are also affected by electric current. According to Kumagai et al. the 1 volts of direct electric current, provided with potentiostat, significantly damaged HIV1 infected MAGIC-5 cells after exposed 1 minutes. According to this study virus envelopes and cell membranes are affected from electrical stimulation and might be entry of viruses into cells had been inhibited. Additionally, no any differences, neither negative nor positive, has been observed in MAGIC-5 cells (host cells) compared viruses [19]. Additionally, electric stimulation can inhibit the growth of SARS-CoV-2 and repairs lung and heart functions [20]. This can be useful data for novel antiviral treatment methods. Furthermore, different HIV species with application of low electric potential, infection were found to be supressed. Compared to normal cells, HIV is also sensitive against electric current [21]. Electric current can affect viruses through different mechanisms. For instance, ROS species had also suggested to have an anti-viral activity [22] near anti-bacterial activity. Tominaga et al. found out that 1V of electric stimulation during 5 minutes can increase hROS and NO species levels [21].

HeLa cells infected with HIV-1LAI was shown to be more sensitive than HeLa control cells with no any infection [23].

Electric current applications can affect some virus infections diseases such as Herpes virus [24]. Low voltage can degrade spike protein on virus membrane and decrease virus activity. According to Allawadhi et al. low voltage current application on COVID-19 can be supportive effect on therapy regime [20].

Effect of Temperature on Covid-19 and its Link to Electric Effect

According to some studies, wintertime and its low temperature affects transmissibility of influence virus [25,26]. Other coronaviruses which courses with weak respiratory symptoms, such HCoV-OC43 and HCoV-HKU1, are also seasonal [27,28]. High temperature can affect virus pathogenesis *via* inducing innate and adaptive immune system mechanisms [29]. Heat effect can be generated by multiple mechanisms including pharmaceutical methods, physical methods and cultural treatment methods. According to its healing effect on infection and common cold, the applications of hot baths, steam rooms and saunas exist in cultural practice which mimics fever through heat, generated outside the body [30]. Such traditional healing applications was shown to reduce risk of viral infections [31]. At low temperature conditions enveloped viruses can protect their activity. Due to their sensitivity to high temperature, it is used to deactivate them by destructing their lipid membranes. Because of their membrane resistance its destruction by temperature weakens tolerance of viruses against human immune system and vaccines [31-34].

Alternating magnetic field can generate electric current in conducting tissues, similar to carry out in copper wire. Proper frequency of these magnetic field can generate same frequency of alternating electric current in tissues. With the help of extremely low (0-300 Hz) and low frequency (300-100,000 Hz) magnetic fields, these tissues heat is built up [14].

Hypothesis

All organisms consist of protons, neutrons and electrons. These basic properties of living organisms make link between biological organisms and physics laws. Electrons, exist both in living organisms and non-living physical environment, make living organisms to be exposed physics and physical parameters. Electrical processes are present in the form of lightning and air ozonation factors in nature and therefore in organisms at the cellular and molecular levels. Magnetism and electricity are different but interchangeable physical processes and are therefore referred to as electromagnetism. Based on studies above, one may foresee that single cell organisms, bacteria and viruses can be affected by both magnetic and electric fields. Our hypothesis is on non-pharmaceutical approach of novel coronavirus patients *via* electric and magnetic fields. Even though it's not too much, considering successful results obtained from studies, where electric and magnetic fields are applied, we propose to focus on pulsed magnetic field or pulsed electric current for coronavirus patients. Especially applying a pulsed magnetic or electric field at a frequency appropriate to the frequency of heat motion of molecules can generate heat. As well as pulsed electromagnetic field stimulates immune system.

Conclusion

Besides inhibiting its growth electric current can also help the repair of some staminal organs such as lungs. It is also very important that NPs affects viruses through penetrating lung cells, according to the studies. In another hand conventional therapies against virus infection such as vaccination or serum can be effective but due to the ability to mutate rapidly, which is a general feature of viruses make this process makes it difficult. For this purpose, we hypothesize that as an alternative and supportive treatment and by applying a completely non-chemical method, it will help the traditional medicine method in combating the epidemic.

Conflict of Interest

The authors declare that there is no conflict of interest.

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