Using Transcranial Magnetic Stimulation to Detect Aluminium And Mercury Preservatives Accumulated in The Brain from Vaccines

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Abstract

Since the 1980s, the Center for Disease Control and Prevention has changed their recommended childhood vaccination schedule from 22 doses of seven vaccines by the age of six to 50 doses of 14 vaccines by the age of six. In a similar timeframe, the prevalence of Autism Spectrum Disorders (ASD) has increased. It is possible that these two are related. This paper intends to hypothesize that Transcranial Magnetic Stimulation (TMS) could be utilized to detect levels of mercury and aluminium in the brain, due to the magnetic properties. TMS works by sending magnetic field pulses into both the Peripheral and Central Nervous System. If we can connect the magnetic field pulses to the magnetic properties of mercury and aluminium, we can potentially track how the mercury has affected the brain and determine if this may have caused ASD.

Keywords: Autism Spectrum Disorder, Transcranial Magnetic Stimulation, Vaccination, Diagnosis, Treatment

1. Introduction

In 1983, the Center for Disease Control & Prevention (CDC) recommended a childhood vaccine schedule of 22 doses of seven vaccines by the age of six, followed by 24 doses of seven vaccines by the age of 18. By 2017, the CDC had altered their recommendations to 50 doses of 14 vaccines by the age of six, followed by 69 doses of 16 vaccines by the age of 18 [1]. This abrupt change has raised concern about how the increase in injections could be affecting the development of children. The simultaneously increased development of Autism in children was analyzed in parallel with these changes in vaccinations. In the 1980s, the CDC reported that the prevalence of Autism Spectrum Disorder was 1 in 10,000. In the early 1990s, it had increased to 1 in 2500 and, in the late 1990s, 1 in 1000. This rate has still continued to grow: In 2018, the CDC's Autism and Developmental Disabilities Monitoring (ADDM) reported that approximately 1 in 59 children in the United States had been identified as having an ASD. The jump from 1 in 10,000 to 1 in 59 in less than forty years has caused large panic and a call for additional research to determine the cause of the continuous and sudden increase in the prevalence ASD symptoms [2]. [3]

2. Vaccinations & Preservatives

Millions of vaccines are given each day, all around the world. Ensuring that those vaccines are potent, sterile, and safe requires the addition of extremely small amounts of chemical additives. These chemicals are added to vaccines for the purpose of inactivating the particular virus or bacterium, helping to stabilize the vaccine. The inactivation and stabilization of the vaccine helps to preserve and prevent the loss of potency over time.

Common additives found in vaccines are thimerosal, aluminium, antibiotics, egg protein, formaldehyde, and monosodium glutamate. Thimerosal is a mercury-based preservative, shown in *Figure 1*, used in many vaccines in the United States. A vaccination fact sheet from the CDC explains that all routinely recommended pediatric vaccines manufactured for the U.S. market are available in formulations that contain no thimerosal or only trace amounts [4]. The question that needs to be asked is how many guardians are aware of this option; if it is an option, should the majority of vaccinations still contain mercury?

The specific type of mercury that thimerosal contains is called ethylmercury, which is cleared from the human body relatively quickly and has decreased likelihood to cause harm; however, this does not mean it is safe to inject into babies, toddlers, and underdeveloped species [4, 5]. The quantity and frequency of vaccinations can increase the effects of even the most minimal traces of preservatives.

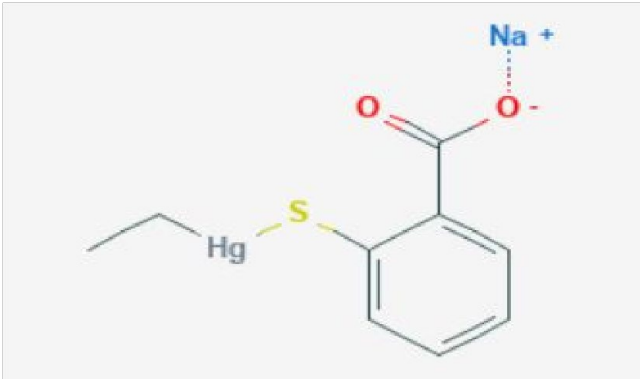

Figure 1: *Thimerosal molecular structure* [10].

3. Magnetic Fields

Discussed previously were the commonality and makeup of additives of vaccinations. If we further consider mercury and aluminium, we know that aluminium is a paramagnetic material. Paramagnetic materials have magnetic permeability of greater than or equal to 1, meaning they are attracted to magnetic fields. *Figure 2* displays how magnetic fields affect electron pairs from molecules.

Lenz's Law can be used to understand the function of the Transcranial Magnetic Stimulation (TMS) system and the interactions these treatments have with patients' brains. This law states that when induced electromagnetic

field (EMF) creates a current through a conductor, that current generates an opposing emf. The occurrence is shown as a negative sign in Faraday's Law of induction:

$$\varepsilon = \frac{-d\Phi}{dt}$$

The EMF (ε) is described as the opposite of the differential of magnetic flux (Φ) per unit time [12].

TMS involves the placement of an electromagnetic coil on the patient's head. This coil creates a magnetic field, sending pulses into the brain. The magnetic pulses that TMS sends through the cortex disrupt the electrical pulses of the neurons, exciting them. A low-level diagram of the magnetic field produced with TMS is shown in *Figure 3*. The EMFs utilized in TMS treatment are calculated using Faraday and Lenz's laws. The small current that is sent through the brain alters the EMFs, inciting changes in the neural circuits. These neural changes have successfully been used to treat patients with depression, epilepsy, and many other neurological disorders. Since TMS has shown ability to alter EMFs and change neural networks, it has promising ability to strongly and positively impact not only the disorders previously mentioned but many more, including autism spectrum disorder.

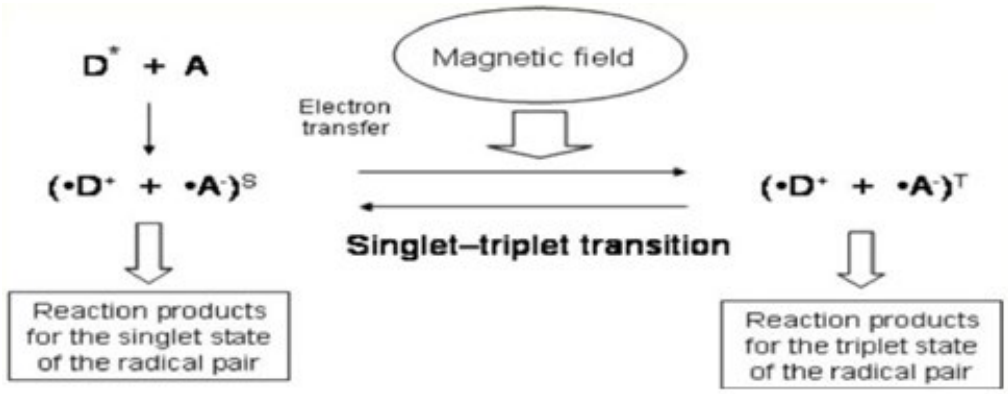

Figure 2: *Process of reaction involving radical pairs depending on magnetic field. An electron is transferred from donor to acceptor molecule producing a radical pair. The external magnetic field affects the transition between the singlet and triplet states of the radical pair* [9].

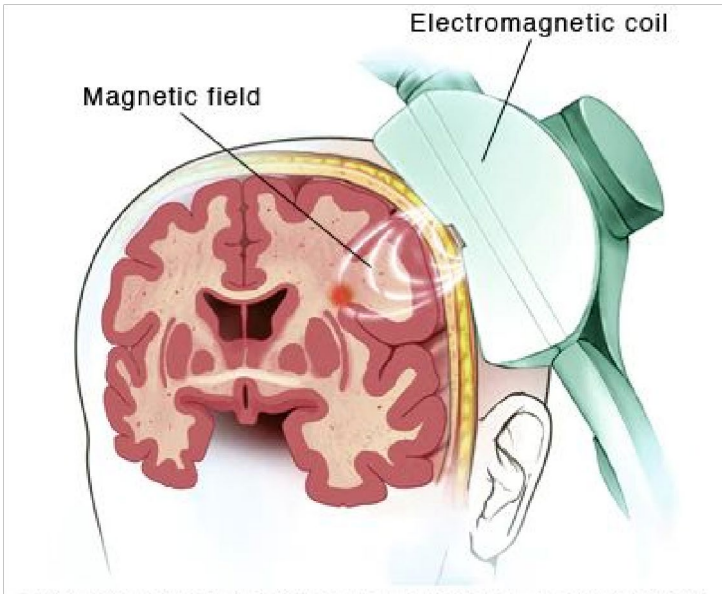

Figure 3: *TMS treatments use an electromagnetic coil to produce a magnetic field that alters neural emfs and can affect the symptoms of many neurological disorders* [11].

4. Transcranial Magnetic Stimulation

Transcranial Magnetic Stimulation induces small magnetic fields for stimulation. It is a safe, non-invasive, painless technique proven thus far to be a unique tool capable of stimulating both central and peripheral nervous systems. It is a method for focal cortical stimulation where small intracranial electrical currents are generated by a rapidly fluctuating extracranial magnetic field. These currents can then activate nerve cells and stimulate the tissue in the brain. The attenuation produces various effects throughout the neural network [7, 8]. This process is further shown in *Figure 4*.

In May 2014, field experts met for the Transcranial Magnetic Stimulations Therapy for an Autism Consensus Conference. These experts discussed the newly indicated potential of TMS for use in both therapeutic and analytical applications for ASD. A paper from the Harvard Library written by co-author Lindsay M. Oberman, PhD, spoke to the use of repetitive transcranial magnetic stimulation (rTMS) for altering, either temporarily or permanently, the cortical functions for ASD patients. Through variations in the placement of stimulation, pulse frequency, coil specifications, distinct effects are produced. TMS instances provide a means for analysis of the pathophysiological condition of patients with an ASD. [6, 7, 8]

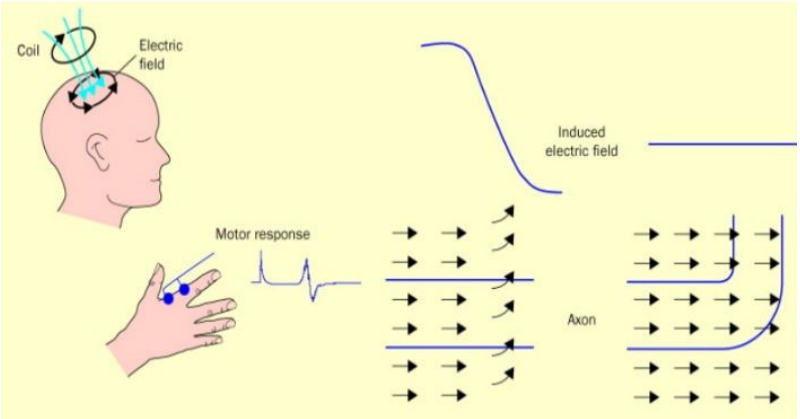

Figure 4: Basics of TMS- Electric currents flow quickly through the coil, generating a magnetic field. *The magnetic field induces an electric current in the brain tissue, in the opposite direction. The flow of current from the*

induced electric field changes along the length of nerve fibres and results in transmembrane current. Finally, a bent nerve and the uniform current in the uniform electric field also results in a transmembrane current [10].

With different specifications, the results of rTMS have been documented as having different results. Patients who received a low-frequency treatment, defined as less than 1 Hz, typically report inhibitory effects. Alternately, those receiving more than 5 Hz experience neural excitation. These effects last variable amounts of time, greatly influenced by this frequency and also by the pulses and intensity [11]. It should be noted that TMS treatments have before been utilized in the treatment of depression and other similar neurological conditions. Most applications of rTMS settings and usage have focused on depression, not the treatment and investigation of ASD. rTMS has been part of many neurological conditions which is why there is promise for ASD treatment as well.

From the same paper, Manuel Casanova, from the Department of Psychiatry and Behavioral Science at the University of Louisville in Louisville, KY, provided a review on the pathophysiology of ASD. Postmortem studies have shown evidence of abnormalities of neuronal migration in the brains of individuals with ASD. Abnormalities were described as displaced neurons, appearing as focal cortical dysplasia in a majority of individuals with ASD. Also, morphometric analysis of cells within the malformed cortex suggested a reduced number of interneurons [7, 8].

It is hypothesized that ASD could be both analyzed and treated using TMS. The use of magnetic field and the flow of induced electric current along nerve fibers, shows hope that TMS may be able to provide medical researchers with an understanding of the underlying development of the millions affected by ASD. Additionally, TMS research could lead to an implementation of different stimulation types to provide therapeutic options to improve a variety of behavioral dysfunctions associated with ASD [7].

An article from The National Center for Biotechnology Information, "Possible Mechanisms Underlying the Therapeutic Effects of Transcranial Magnetic Stimulation," reported that the total therapeutic effects of rTMS may be determined by their total impact on a number of processes in the brain, including LTP, LTD, changes in cerebral blood flow, the activity of certain enzymes, interactions between cortical and subcortical structures, and gene expression. A simplified diagram of the effects of TMS on these processes is provided in *Figure 5*. The location of the impact, the intensity and frequency of the stimulation and the protein and physicochemical conditions of the stimulated area are also of particular significance when determining the effects of TMS therapy.

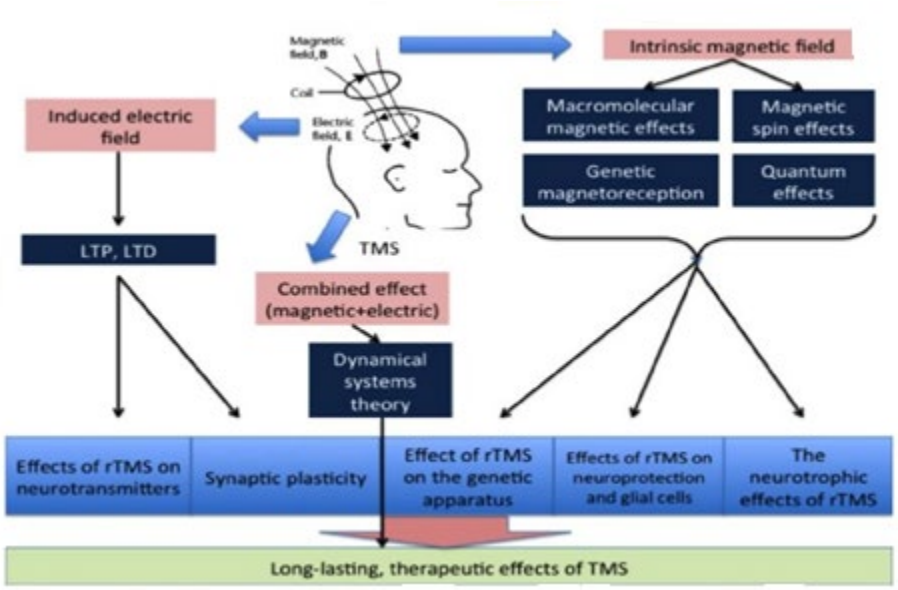

Figure 5: *General overview of the influence of magnetic and electric fields from TMS on the Nervous system* [9].

5. Future Research

Many signs point to a correlation between the increase of vaccines and increase in autism. However, it is important to recognize and consider all aspects that have a potential relation to the increase in autism in the United States. Examples of changes in the past few decades that may cause changes in ASD prevalence could be environmental changes such as genetically modified organisms (GMOs), as well as an increase in daily radiation exposure (increased usage of cell phones, laptops, and other electronics) that may be releasing minute amounts of radiation that could be affecting development. It is also important to think about how the ASD criteria for diagnosis has changed and expanded which could add to the increased prevalence of autism in the world.

6. Conclusion

In less than half a century, the number of recommended vaccines for children younger than six has more than tripled. In the same span of time, the occurrence of ASD has also increased drastically from the early 1990s being about 1 in 2500 to the 2018 reports from CDC's ADDM statistics claiming approximately 1 in 59 children in the USA are likely to be diagnosed with ASD [13]. Many researchers and scientists have hypothesized that the two are related. This paper draws a connection between this standing hypothesis and Transcranial Magnetic Stimulation. TMS can be utilized to gather more information about ASD as well as to help manage many of its symptoms.

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Don't say we, me, I.

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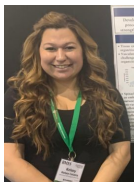
Biographies

Dr. George P. Pappas is an Assistant Professor of Electrical and Computer Engineering at Lawrence Technological University, Southfield, MI, USA. He has also taught Biomedical Engineering courses in biomedical devices and imaging processing. He has over 10 years of teaching and research experience in embedded systems. He has been the PI for a recent DENSO grant in machine vision safety systems in vehicles. He has been with the Electrical and Computer Engineering Department since 2016. He received his masters and Ph.D. from Oakland University, Rochester MI, USA. He has taught and mentored students in the areas of embedded systems, encryption and security, imaging processing in medical and automotive applications, microcontrollers, and High-Performance Computing systems, artificial intelligence and machine learning algorithms.



Kelsey Catania is a senior undergraduate student, working toward her B.S. in Biomedical Engineering and Minor in Nanotechnology at Lawrence Technological University, Southfield, MI, USA. She is an ongoing member of the Biomedical Engineering Society and has presented multiple research projects at the 2018 and 2019 BMES Annual Meetings. Her past research projects focus on decellularization of spinach scaffolds, benefits of distributed frequency therapy, and tissue scaffolding for burn victims.