**Looking up the Rabbit Hole: Possible Early Diagnosis of Alice in Wonderland Syndrome**

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**Abstract**

This paper covers the hallucinatory disorder known as Alice in Wonderland Syndrome (AIWS) and whether or not it is possible to diagnose this disease early. Research on the disorder was done by looking up the history of AIWS, the causes and symptoms of AIWS, and three different case studies of AIWS. AIWS was first mentioned by Lewis Carroll in his children’s book known as *Alice in Wonderland* and was finally documented medically in 1952. Some common causes of AIWS are migraines, Epstein-Barr Virus, and the Varicella-Zoster Virus which are looked at in this paper. An in-depth look at AIWS is also done as a list of symptoms are listed as well as what they affect. The three case studies are on three different individuals of different ages and sexes. This includes an eight-year-old girl, a thirteen-year-old girl, and a fifty-six-year-old man. These case studies show how different AIWS is for each individual. In the end, it is not possible to early diagnose AIWS due to its many uncertainties and similarities to other hallucinatory disorders.

*Keywords:* Alice in Wonderland Syndrome, AIWS, Varicella-Zoster Virus, Epstein-Barr Virus, Migraines

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Alice in Wonderland Syndrome (AIWS) is a rare perception disorder that can distort visuals, space, and time to the afflicted person and is normally caused by other ailments or issues. This disorder afflicts the sensory associated cortices which deal with the development of internal-external relationships. What this means is that there is an unbalance between the relationship of how one views themself and the environment around them, which gives the afflicted party a skewed view of reality.

**Background**

 This disorder is misunderstood and unknown making diagnosis for this disorder extremely difficult, as research is limited. AIWS has a tendency to afflict younger children, however, it can affect anyone, at any age. More research into this topic would help treat those who are currently afflicted by AIWS and bring knowledge to those who do not know what it is. As there are several causes to AIWS, including migraines and epilepsy, it would everyone know that this can disorder can happen to anyone, at any time, allowing people to remain calm during the duration of its effects.

**Research Question**

 Is early diagnosis for AIWS possible, right now? I choose this topic to research because I found an interesting video a while ago that explained very broadly the effects of AIWS. I was intrigued, and so I decided to look more in-depth about what exactly is AIWS. Along the way, I found that not a lot of information is on AIWS and so I thought it would be beneficial to compile the information I found so that I could make other people aware of this disorder. When researching this topic, I was hoping to find symptoms and triggers to this disorder that would stand out as these factors would make it easier to diagnosis this disorder earlier. First, the history of AIWS, as well as a look at Lewis Carroll’s book called Alice in Wonderland, will be looked at and talked about. Then in-depth research will be shown on the many symptoms, diseases, and ailments that is associated with AIWS. Finally, a couple of cases of AIWS will be reviewed.

**Search Criteria**

 Several different websites were used to produce sources that are in this paper. The database known as PubMed was primarily used to find credible sources regarding AIWS, as PubMed’s resources are always peer-reviewed. When using PubMed, the keywords “AIWS” and “Alice in Wonderland Syndrome” were used to provide the desired results in the symptoms and history of AIWS. For the causes of AIWS, the words researched were migraines, Epstein-Barr virus (EBV), and Varicella-Zoster Virus (VZV) were used as they were found in previous sources. Some of these sources were found using the Google and Google Scholar search engine.

**Literature Review**

**Symptoms and Causes Sources Summary**

In order to approach the topic symptoms and causes must be known in order to diagnose it correctly. First, the disorder comes from infections and other diseases (Liu et al., 2014). Two common diseases that cause AIWS are the Epstein-Barr Virus, EBV, and the Varicella-Zoster Virus, VZV (Omata et al., 2009). From here more causes of AIWS were found sound as migraines, epilepsy, and more (Mastria et al., 2016; American Migraine Foundation, 2017). However, that does not mean AIWS cannot come from a disease that is not known for possibly causing AIWS, like a mycoplasma infection (Omata et al., 2009). From the causes of AIWS, came symptoms and some of those symptoms include teleopsia, micropsia, macropsia, and time distortions (Blom, 2016). With knowledge of AIWS, an early diagnosis might be possible, except for the nature of how AIWS works. Various sources state AIWS that MRIs and blood tests are usually ineffective as the symptoms do not abnormalities normally.

**History Sources Summary**

A slight investigation of Lewis Carroll’s book *Alice in Wonderland* was made to learn more of the first mentions of the disorder in literary works. As it was believed that Lewis Carroll himself struggled with AIWS, and that is why he was able to describe the symptoms. Next was the first medical diagnosis of AIWS which was from Lippman when he described several patients having symptoms of feeling taller or shorter than usual. The term AIWS was then created a few years later by Todd (Mastria et al., 2016).

**Case Studies Summary**

Finally, examples of AIWS being observed were needed to show a variety of symptoms, causes, and possible psychological effects of humans. As AIWS affects all ages, but typically children, a variety of ages were attempted to be found. First, an eight-year-old girl developed AIWS that seemed to be triggered by migraine. She experienced several symptoms of AIWS and then slowly recovered after five months (Matsuura et al., 2019). Next, a thirteen-year-old girl who was experiencing AIWS along with panic attacks whenever these episodes occurred. As she would see visages of people attacking her and could not move well during this time. She also describes several symptoms of AIWS and eventually recovered after a couple of weeks (George & Bernard, 2013). Finally, a fifty-six-year-old man who has migraines with and without auras feels like a horn, like a unicorn, is growing out of his forehead. These episodes were of regular occurrence and consistently did the same events and actions. (Landais & Michelin, 2019)

**Limits**

 While researching this topic a glaring limitation arose, the amount of resources that covered the topic of AIWS. It is very limited as not much research has been done on the disorder, making it difficult to find sources that relate to the topic at hand. The sources that were found, however, were mostly reliable as they came from a scientific, scholarly areas of study. Making the tradeoff of fewer sources easier to confirm their reliability for scientific exploration.

**Findings**

**The History of AIWS**

 Several artists, of various genres and types, were known to have migraines, which is a known cause of AIWS. Some of these artists are Picasso, De Chirico, and Lewis Carroll. Lewis Carroll was known for having intense migraines as they were written in his diaries. He had experienced AIWS twice in life for unknown durations, or at least that was written, and was once in 1856 and again in 1885. Lewis Carroll, however, is the first person to document AIWS symptoms in literary work, as they are seen in his written children’s books, which are named *Alice in Wonderland* and *Through the Looking Glass and What Alice Found There*. *Alice in Wonderland* was written in 1865 while his second book was written in 1871 (Mastria et al., 2016).

 In the first book, various visual hallucinations are described such as micropsia, objects become smaller, and macropsia, objects become larger. In the second book, various space and time misperceptions are shown. All of which is best explained through the eyes of someone who has had experience with AIWS (Mastria et al., 2016).

 In 1952, a man by the name of Lippman first reported a couple of cases where afflicted people felt extremely tall or extremely short, however, the term AIWS was not used until 1955 by a person named Todd. He called AIWS because people reported to him saying that they felt like they were Alice from *Alice in Wonderland*, hence the name AIWS (Mastria et al., 2016).

**Causes and Symptoms**

 AIWS is not like a normal hallucination disorder where it is caused by genetics or develops due to a traumatic event, it develops as the aftermath or result of an illness or a drug. There is a total of thirty-six different causes of AIWS according to Mastria et al., (2016) with other forms being unknown. Of these known forms, three are looked at in this paper, which are Epstein-Barr Virus, Varicella-Zoster Virus, and migraines.

**Migraines**

First, migraines have a correlation in AIWS cases as most afflicted people that have experienced AIWS have had some form of migraines. There are two forms of migraines according to the American Migraine Foundation (2017), and one is migraines without auras, and the other is migraines with auras. The difference is that migraines with auras have sensory disturbances and only about thirty percent of patients who have migraines experience auras. Normally, people who are known to have migraines with auras do not have auras with their migraines every time either. These visual disturbances are described to be warning signs of migraines according to patients and typically last between twenty minutes to an hour in time. During this time the afflicted person can see various things in their visions such as bright dots, zig-zag lines, or flashes of bright lights. Other, more serious, symptoms can occur such as temporary blindness or a stroke if it lasts for too long. (AMF, 2017)

The reason behind migraines causing AIWS is unknown, other than that auras might cause AIWS, even then, AIWS can happen without auras. However, auras do cause sensory disturbances that can visual hallucinations, which fits in with AIWS. Still, the cause behind migraines causing AIWS is largely unknown (AMF, 2017).

**Epstein-Barr Virus**

 The Epstein-Barr Virus, EBV, is a virus that is a part of the herpes family, also known as Human Herpesvirus IV. It is one of the most common human viruses in the world, as it is found worldwide. Most people get infected with EBV at some point in their life. EBV is also known to cause infectious mononucleosis, or also known as “mono” (Epstein-barr, 2018).

 This virus has several symptoms that are having a fever, a rash, an inflamed throat, an enlarged spleen, a swollen liver, the lymph nodes in the neck are swollen, and the feeling of fatigue. Most people who get this virus, get it in their childhood, and this virus typically does cause any symptoms while in childhood. However, if symptoms do occur in childhood they are normally hard to distinguish from other childhood ailments. Teens and adults who receive this illness normally recover after two to four weeks, however, the feeling of fatigue and tiredness can last for some time afterward. After acquiring EBV, it becomes latent in the body and may reactivate in the future. However, when it does become latent, it does not cause any symptoms (Epstein-barr, 2018).

 It most commonly is transmitted through bodily fluids such as blood, blood transplants, organ transplants, and semen, however, it typically transmits through saliva. Due to this factor, it can also be spread through objects such as toothbrushes and cups (Epstein-barr, 2018).

 Due to EBV looking like other ailments and illnesses, it is hard to diagnose. It can, however, be diagnosed through blood testing, but most adults, nine-out-of-ten, show that they have or have had the virus. There is also no vaccine for this virus, and because it is a virus, antibiotics do not work. The only things that can get rid of this virus are sleep, hydration, and time (Epstein-barr, 2018).

 Its link to AIWS, however, remains a mystery. It is a mystery to scientist why EBV can trigger AIWS, other than it has shown that it does trigger AIWS. As visual hallucinations are not a part of the virus, there is no direct link for causation (Epstein-barr, 2018).

**Varicella-Zoster Virus**

 Varicella-Zoster Virus, VZV, belongs to the alpha-herpesvirus family and is highly contagious and present worldwide. It is a human-only disease meaning it only spreads between humans. The primary version of VZV leads to acute-varicella or the “chickenpox.” VZV is transmitted through direct contact with the skin lesions that form on the afflicted or through the air. After the initial infection, it becomes dormant in the cranial nerve and dorsal root ganglia where it forms a lifelong latency. If VZV reactivates it becomes Herpes-Zoster, HZ, or otherwise known as “shingles” (Pergam et al., 2009).

 Primary varicella, VZV, symptoms are a fever and a vesicular itchy rash that spreads wide across the body, typically located on the face. Symptoms normally disappear after seven to ten days, however, more serious cases of VZV can lead to more threatening diseases such as pancreatitis, pneumonitis, encephalitis, and hepatitis. Adults and children are more likely to be harmed or threatened by VZV rather than HZ, as ninety-percent of adults already experience VZV and most of today’s children vaccinated for VZV (Pergam et al., 2009).

 For adults that have developed HZ, however, have skin lesions that have a dermatome distribution. For example, VZV goes dormant in the cranial nerve and dorsal root ganglia, when it reactivates it travels down the spinal cord and travels down a nerve. It does not typically spread across both sides of the body as one nerve does not cover both sides. It normally also appears on the upper body whether that is shoulders, face, or arms, and only traveling lower if it is in a very late stage. It is estimated that about twenty percent of individuals who had VZV have HZ (Pergam et al., 2009).

 Since it is a virus, there are no antibiotics that can stop VZV or HZ, however, there is a preventive measure for before infection. A vaccine was made to stop VZV and has been given to most children of this generation (Pergam et al., 2009).

 As for how VZV triggers AIWS is also unknown. VZV causes no visual hallucinations and does not cause any symptoms that resemble AIWS (Pergam et al., 2009). All that is known between the link of AIWS and VZV is that VZV can trigger AIWS.

**Symptoms of AIWS**

 After looking at some of the causes of AIWS and not finding a trigger for AIWS, maybe some of the symptoms of AIWS will clue to a possible early diagnosis. First, AIWS affects various perceptions, mainly known for its changes in visual perception, but it can affect somesthetic and other nonvisual perceptions. Somesthetic perception is the sense of feel, so this affects feeling other objects and tasting food. Other nonvisual perceptions include a warping in time or objects changing spatially.

 There is a total of forty-two different visual perceptions and sixteen somesthetic and other nonvisual perceptions according to Blom (2016). This list includes the ones listed in *Alice in Wonderland* and new ones that have been found over the years. The ones found in the first *Alice in Wonderland* were micropsia, macropsia, slowing of time, and depersonalization. However, common symptoms of AIWS are micropsia, macropsia, teleopsia (objects appear farther), pelopsia (objects appear closer), and metamorphopsia (straight lines no longer become straight and instead can look wavy). Other cases of AIWS can include but are not limited to chromatopsia (seeing everything in the same hue), Gyropsia (seeing an illusory, circular movement), Entomopia (seeing multiple images of the same object like an insect), and mosaic vision (objects appear to have a polygonal and crystallize appearance to them like a mosaic). The list keeps going but these visual and nonvisual distortions cover the general idea of AIWS. AIWS also widely varies in duration and can last for minutes to days. It can be a temporary experience or an issue that affects someone for a lifetime (Blom, 2016).

**Case Studies**

 The first case study is an eight-year-old girl who had pressure-type migraines and experienced AIWS. It would start with these migraines and last for about an hour and during this time her symptoms were micropsia, macropsia, pelopsia, polyopia (seeing images in copies of four), dyschromatopsia (seeing colors differently), blistering objects in her eye vision, her body became transparent or absent, hot foods felt colder, and time distortions. The girl is affected by AIWS for many years now and the symptoms are not as frequent but still occurring. There was a moment in time where these headaches lasted for hours at a time, but as previously stated has been lessened (Matsuura et al., 2019).

 The second case study is a thirteen-old-girl where a patient experiences extreme distress to the point of panic attacks. Her symptoms are that she hears muffled voices, initially, but then they grow louder clearly saying the word “death,” she sees black images with red eyes coming toward her, time distortion, pelopsia as the floor seems very far away, and fatigue. In between attacks, she would feel anticipatory anxiety as she did not want to experience it again. After a couple of weeks of psychoeducation, relaxation therapy, and cognitive behavior therapy she no longer experiences AIWS (George, 2013)

 The third case study is a fifty-six-year-old man who has regular migraines with and without auras. The subject reports intense pain in the forehead as he has a body image distortion where he appears to have a horn, much like a unicorn, appears out of his forehead. He continues to suffer from this issue. (Landais & Michelin, 2019)

 What these case studies have in common is that they are caused by migraines or headaches. Other than that, they are completely different, all of the symptoms are different, the durations vary, and the results and different.

**Results of Research**

 Early diagnosis of AIWS, at the moment, is impossible. Too many variables go into play when trying to determine whether or not someone has AIWS or not. Such as the exact cause of AIWS is unknown, certain diseases, infections, viruses, and substances are linked with AIWS but the exact trigger for it is unknown. The symptoms of AIWS are too plentiful and cover a wide variety of other hallucinatory disorders like schizophrenia.

**Future Research**

A question remains about the nature of AIWS, and that is what triggers AIWS? If this question could be answered, then an avenue of answer might open up. As knowing this answer would answer how exactly does AIWS affect the mind. It would show the mechanisms behind the disorder and allow an early diagnosis to be possible for AIWS. The continued research of this topic would be good, as it would help a lot of individuals, ranging from children to adults, who are being affected by AIWS and who are unaware of its issues. It would be suggested to research the known diseases, substances, and circumstances that cause AIWS, like migraines, and further research why they can cause AIWS. Whether these triggers affect a certain portion of the brain when “x” does “y,” or if it is based on a certain gene that individuals have that cause the trigger when exposed to certain ailments. All of which can be explored to find answers.

**Conclusion**

 Is it possible to early diagnose AIWS? The answer to this question is no. The reason for this is because of the many unknown factors of AIWS and the lack of research on this hallucinatory disorder. Research on AIWS grows but too much is still unknown about the disorder, like the triggers of AIWS. Some causes of AIWS were found like EBV, VZV, and migraines but as to why they trigger AIWS is still largely unknown. Another factor is that there are no key symptoms to AIWS as they vary from person-to-person. AIWS can also appear to be like other hallucinatory disorders like schizophrenia and paraphrenia. The only thing a doctor can do is run the various tests until they arrive at AIWS, at the moment.

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