

The Causes of Brain Changes and Emotional Regression in People with Autism Spectrum Disorder

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Abstract. This paper will explore the connection between the changes in certain parts of the brain caused by ASD, such as the reduction in the volume of the prefrontal cortex and emotional regression (where patients suddenly lose self-control and return to their childhood way of thinking). For this paper, it employed the method of literature review to select papers from the past decade, most of which were sourced from authoritative official websites (such as PubMed) and those published by psychologists. The causes of ASD include environmental factors, genetic inheritance, genetic mutations and the physical condition of the mother during pregnancy. The main reason is that innate decisions are not, as most people think, caused by incorrect education or neglect later in life. ASD can cause changes in certain parts of the brain, which in turn can lead to symptoms of emotional deterioration. The specific details will be discussed in the main body section.

Keywords: autism spectrum disorder, brain changes, emotional regression, patients' emotionalism, intervention.

1. Introduction

Autism Spectrum Disorder (ASD) is a kind of pervasive developmental disorder. There are signs as early as infancy, symptoms often visible by the age of two or three. However, some patients may not be diagnosed until they reach adulthood. The symptoms are specifically manifested in communication difficulties, repetitive behaviors, and overly sensitive senses (Manual of Mental Disorders). When facing difficulties, they may appear at a loss and refuse to communicate, such as suddenly getting emotionally agitated (hysterical outbursts) or shouting. In the report of the Centers for Disease Control and Prevention (CDC), the prevalence of ASDs was estimated to be 2.64%. Meanwhile, in a recent survey, one in every 68 American children had autism [1]. ASD will lead to brain change, and emotional degeneration. The most common symptom of ASD patients is a language disorder in early childhood. This is because the right IFG and bilateral temporal regions of children with ASD are more active and the volume of the frontal and temporal lobes of the brain increases at the same time [1]. The currently more common treatment methods for ASD include drug therapy, psychotherapy, and social intervention, and these will be discussed in detail.

The aim of this paper is to figure out what the factors that can lead to the identification of changes in the brain of people with autism (such as biological, environmental, and psychosocial factors). Also, explore the mechanism of action between brain changes and emotional decline. This

research question will combine all the questions above, if a close connection is found between the two aspects (which are, brain changes and patient emotionalism). Then, more precise treatment methods or intervention measures will be brought to ASD patients.

2. The neurobiological basis of autism

2.1. The brain structure of patients with ASD

MRI is the most accurate method for detecting the brain details of patients with ASD. In the MRI reports of ASD patients, changes have occurred in the total brain volume of the patients, as well as in the frontotemporal lobe, frontal epithelium, amygdala, hippocampus, orbital frontal cortex, right superior temporal groove, right inferior frontal gyrus, left tibial cortex, and basal ganglia [1]. Patients with ASD experience an increase in brain volume and amygdala during childhood, but a decrease in brain capacity when they enter adolescence. Abnormalities in these areas can lead to deficiencies in language processing and attention in patients, thereby causing them to engage in behaviors that are harmful to society [1]. The brain structure of boys and girls with ASD in infancy and early childhood is slightly different. The brain volume of boys grows faster (by about five to ten percent). However, the volume of a girl's brain will not increase significantly [2]. This indicates that it is caused by ASD. There are individual differences in the changes of brain parts in terms of gender. This indicates that male patients with ASD are more prone to sensory overload and executive difficulties.

2.2. The internal connection in the brain for patients with ASD

Compared with healthy individuals, patients with ASD tend to have both excessive and poor connections within their brains. The functional connection between the right lateral superior iliac region and the frontal area is overly dense, leading to the patient's excessive resonance or indifference when interacting with others. The reason for this situation is that the patient's brain developed excessively in the early stage [3]. In 2004, Just and his colleagues' study proved that patients with ASD have insufficient cortical connectivity. This leads to a decrease in the patient's coordination, and at the same time, their social cognition, language, and executive functions will also deviate from those of healthy people.

2.3. The neurotransmitter system in patients with ASD

Glutamic acid and serotonin are the main causes of the development of autism, because glutamic acid leads to neuronal damage and changes in brain development. High serotonin levels can cause difficulties in social interaction and communication as well as affect the connections between other nervous systems [4]. Some other neurotransmitters can also aggravate ASD, such as glycine (which makes it impossible for the patient to maintain continuous excitement), norepinephrine, and acetylcholine (which makes patients difficult to concentrate) [4].

3. The causes of brain changes in patients with ASD

3.1. The influence of genetic factors on ASD

Genetic factors can greatly influence ASD. More than 50 percent of autism cases involve genetic factors. If parents have ASD, the probability of their children developing the disease is 1.2 to 1.3

times that of ordinary people. In the case of identical twins, if one of them has ASD, the probability that the other has ASD is 60% to 90% [5]. The probability of fraternal twins having ASD at the same time is much lower. Gene mutations in neuronal synapses can cause common symptoms of ASD such as sensory overload, anxiety, and behavioral repetition [5].

3.2. Environmental factors

In addition to genetic factors, environmental factors are also one of the reasons that increase the risk of ASD. The age of parents is one of the considerations. Older parents are more likely to have children with genetic mutations because the quality of sperm and eggs declines. Infections and medications used by the mother during pregnancy can also affect the risk of fetus developing ASD. According to research, antidepressants, anti-epileptic drugs and benzodiazepines (for treating anxiety and sleep disorders) increase the risk of ASD in the next generation [6]. Diseases such as colds, fevers, and viral infections pose greater harm to pregnant women and their fetuses. However, the probability of them causing ASD in the fetus is different. According to current research, the risks increased by different symptoms varies. Viral infection increases the risk of ASD by 2.8 times, fever increases by 2.1 times, and bacterial infection increases by 1.4 times [7]. Obesity during the perinatal period and type-2 diabetes can both lead to hormonal imbalances, thereby simultaneously affecting the immune functions of both the pregnant woman and the fetus. This means that metabolic hormones will also be disrupted, thereby leading to a slowdown in the development of brain nerves [7].

4. Emotional regression in autism

Emotional regression refers to the situation where, when a patient is confronted with external forces they cannot bear, such as stress, anxiety, or trauma, their psychological state unconsciously reverts to that of their childhood, and they exhibit the same behaviors, emotions, and thinking patterns as at that time (childhood) [4]. The emotions of patients with emotional degeneration are very unstable. They might suddenly lose their temper, make a fuss like children, or exhibit very childish behavior. Apart from PTSD, ASD is also one of the causes of emotional deterioration and regression. The common symptom of ASD is sensory overload. When the senses are overly sensitive for a long time and cannot bear it, it will cause the patient to have the most primitive and instinctive reactions (emotional outbursts and shouting). Even minor changes in daily schedules can make ASD patients feel anxious (they are obsessed with details), and they may also break down emotionally when they feel unable to cope. When patients feel their emotions deteriorate, their amygdala may become overly active, leading to excessive emotional sensitivity. This is because the disordered hormones in the prefrontal cortex damage its function, preventing it from suppressing the amygdala and causing patients to lose rational thinking. Take a specific example of an ASD patient experiencing emotional regression. When a child with ASD's regular schedule is disrupted - for instance, being asked to do homework at the time when they should have a snack because there is not enough time for a snack at a family gathering in the evening - they will start shouting for a snack and refuse to communicate. At this point, it takes the help of family members hand in hand to return to normal. For ASD patients who show signs of emotional regression, a fixed schedule and a quiet environment can significantly reduce their chances of developing the disease. At the same time, it is necessary to control the patient's own social time. After a period of social interaction, a certain amount of rest time is required.

5. The relation between emotional regression and brain changes

There is now evidence that ASD can lead to brain changes and emotional regression. The following will provide a more specific explanation of the connection between brain changes and emotional regression. As mentioned in the main body paragraph 2.1 of the main body, fMRI detection can most clearly reflect brain changes. fMRI will show the activity level of blood oxygen in the brain. The amygdala of the person being tested will remain in an overactive state for a longer time, and its connection with the prefrontal cortex will also weaken. This means that the patient's mood will become more irritable, and it will be more difficult for them to think rationally. Studies have shown that as people age, their abilities generally decline, so the elderly are more likely to display emotions such as fear, anger, and sadness [8]. This is also one of the typical symptoms of emotional deterioration. In addition, sMRI is also a relatively effective detection method. In the report, the most significant changes in brain regions were the hippocampus (regulates the functions of memory, and stress regulation) shrinks, and the prefrontal cortex volume (responsible for advanced cognitive and emotional regulation) reduces. The longer the symptoms last, the greater the impact on emotion will become.

The transcranial magnetic stimulation (TMS) experiment also proved a similar principle. The TMS experiment artificially stimulated the brain (prefrontal cortex) of patients with symptoms of emotional regression, and the results showed that external stimulation to the brain reversed the emotional regression response. In addition to changes in the volume of brain regions, hormonal imbalance in the brain can also lead to emotional decline. The imbalance of neurotransmitters such as serotonin, norepinephrine, and dopamine in the brain can lead to empathy disorders in patients (hard to empathize or excessive empathy, because these neurotransmitters are involved in reward and emotion regulation pathways). Stress can affect brain regions and lead to emotional deterioration. High stress can lead to an increase in cortisol concentration, thereby affecting the ability to manage emotions. In summary, changes in brain structure and function, imbalance of neurotransmitters, and abnormalities in the stress response system jointly explain the neural mechanisms underlying the decline in emotional function in patients with ASD

6. How can society help ASD patients

6.1. The existing ASD treatment methods

There are two treatments for ASD patients: behavioral therapy and drug therapy. Behavioral therapy is a long-term, and correct behavioral guidance provided by psychotherapists or family members to patients to enhance their social, learning and communication skills. Social skill training is the most common intervention method for ASD. Positive intervention for patients should be carried out from the aspects of sleep quality, dietary issues, toilet training, and emotional training [9]. Antidepressants and anxiety medications are used for patients if behavioral therapy does not work [10]. It is necessary to note that there is no drug that can directly cure ASD. The existing drugs can only treat the complications of ASD to relieve symptoms. However, it is necessary to communicate with the doctor in a timely manner, as the patient should choose drugs with fewer side effects. Not only that, but most of the drugs are also prescription drugs and need to be prepared by professional doctors.

6.2. The attitude of society towards ASD

With the development of The Times, people's attitudes towards mental disorders have become more easygoing. Despite this, some rather conservative regions still hold some prejudice against ASD. They may misunderstand the cause of ASD and attribute it to their parents' indulgence, especially in school, where they are more likely to be discriminated against and isolated. The World Psychiatric Association pays more attention to the condition of patients with ASD. WPA has conducted more research on ASD, which has promoted earlier intervention and more precise treatment methods for ASD patients. WPA helps people in remote areas reduce the stigmatization of ASD and change public attitudes.

6.3. The lifestyle of ASD patients

Patients with ASD usually have a fixed schedule and a sense of time. Because frequently changing schedules can lead to the patient's emotional regression. They prefer to go to less crowded and quieter places (such as libraries). Nor will they go to crowded areas (such as shopping malls). If it is necessary, they will choose the time when there are fewer people. When it comes to career choices, they tend to prefer jobs that allow them to focus on their own fields (such as art). When it comes to making friends, they tend to prefer a high-quality way of making friends rather than a diverse one.

7. Discussion

Although there has been sufficient discussion about the connection between brain changes and emotional degradation caused by ASD, there are still some limitations that have not been adequately studied. First of all, the symptoms expressed by emotional regression are sometimes subjective. There is now sufficient evidence (such as fMRI) to show changes in brain regions. However, there are relatively few studies on patients' subjective consciousness. That is to say, the researchers only observed the superficial behaviors exhibited by the patients, such as screaming and shouting. But they have no idea what the patients are thinking in their hearts, because during the period of emotional regression, they find it difficult to communicate with others. If researchers understand the true inner thoughts of patients, they can make more precise psychological interventions and counseling to reduce the frequency of emotional regression. It has increased the probability and efficiency of successful treatment. However, there are also some deficiencies in ASD research. Most of the current data is based on male ASD patients, while the data on female ASD patients is even scarcer. However, the behaviors exhibited by the two genders when they have ASD are biased. There are still some biases in society towards ASD. They have difficulty distinguishing it from other mental disorders (such as anxiety disorders and depression), and sometimes they think that their children have anxiety disorders and treat them in the way they think is correct.

Although today's society has become quite tolerant of mental disorders. But the prejudice of the past is hard to eliminate. The Mental Health Association should arrange for schools, especially primary and junior high school students, to conduct popular science on mental disorders to eliminate their misunderstandings about patients. Although scientists have now discovered that the brain regions of ASD patients have been altered, there is currently no specific method or surgery, to help the patients' brains return to their original state. Of course, this is indeed very difficult. Researchers can devote more energy to curing the complications of patients. Therefore, in the future, researchers and scientists should increase the database of ASD patients, not only limited to a single gender, but also expand to different ages, genders, and groups of people, such as whether those with other brain

diseases will affect the development of ASD for patients. At the same time, its influence should be further expanded to make more people aware of it and thereby reduce stigmatization. Overall, the current research status is quite satisfactory for ASD studies.

8. Conclusion

The brain changes caused by ASD can have an impact on emotional degradation, leading to a higher frequency of emotional changes or more intense reactions. If the investigation points out the connection between the two, we can provide them with more precise treatment or advice and assist with medication. Meanwhile, as mentioned in the previous main body chapter, there are no drugs that can directly treat ASD and mood deterioration. There are only drugs that can slow down complications. If the connection between them is clarified, it may assist future drug research to develop drugs that can treat the root causes of ASD and mood deterioration. Explain clearly the causes and specific conditions of ASD. It can reduce social panic over it, as most ASD patients are harmless. The resulting emotional deterioration is mostly manifested in becoming extremely agitated, unable to take care of themselves, or communicate normally with others. Although they may show some aggression, they are not as dangerous as those who are not familiar with the condition might imagine. Also at the social level, due to the particularity of ASD, they can focus. And perhaps they have some kind of talent that has not been discovered. The changes that occur in their brains may lead them to have extremely high talent in a certain aspect. Discovering such talents in future investigations can promote social development. In the simplest terms, the practical significance of investigating the connection between the changes in certain parts of the brain caused by ASD and emotional regression can be divided into social and medical aspects.

From a social perspective, it can reduce the rejection of ASD. From the family perspective, it can help the patient's family members have a more accurate understanding of them, reduce their sense of panic, and at the same time provide a solution that can alleviate the symptoms. From a medical perspective, this provides more methods that can be attempted to treat ASD. Not only from the perspective of behavior and psychology, but also from the viewpoint of neuroscience. Therefore, it is necessary to study the connection between the two perspectives.

References

- [1] Ha, S., Sohn, I. J., Kim, N., Sim, H. J. and Cheon, K. A. (2015) Characteristics of brains in autism spectrum disorder: Structure, function and connectivity across the lifespan. *Exp Neurobiol.* 273-284.
- [2] Nordahl, C. W., Lange, N., Li, D. D., Barnett, L. A., Lee, A., Buonocore, M. H., Simon, T. J., Rogers, S., Ozonoff, S. and Amaral, D. G. (2011). Brain enlargement is associated with regression in preschool-age boys with autism spectrum disorders. *Proc Natl Acad Sci U S A* 195-200.
- [3] Kana, R. K., Maximo, J. O. and Cadena, E.J. (2014). The implications of brain connectivity in the neuropsychology of autism. *Neuropsychol.* 16-31.
- [4] NeuroLaunch editorial team. (2014). Neurotransmitter imbalance in autism: The role of excess neurotransmitters. NeuroLaunch. Retrieved from <https://neurolaunch.com/which-neurotransmitters-excess-may-be-responsible-for-autism/>
- [5] Rylaarsdam, L. and Guemez-Gamboa, A. (2019). Genetic causes and modifiers of autism spectrum disorder. *Front Cell Neurosci.* 13: 385.
- [6] NeuroLaunch editorial team. (2024). What medicines during pregnancy causes autism? The hidden risks: Which medications during pregnancy may trigger autism? *Pregnancy Baby Care*. Retrieved from <https://neurolaunch.com/what-medications-cause-autism-during-pregnancy/>
- [7] Love, C., Sominsky, L., Hely, M. O., Berk, M., Vuillermine, P., Samantha L. and Dawson M. (2024). Prenatal environmental risk factors for autism spectrum disorder and their potential mechanisms. *BMC Medicine*. Retrieved from <https://bmcmmedicine.biomedcentral.com/articles/10.1186/s12916-024-03617-3>

- [8] Karl, V. and Rohe, T. (2023). Structural brain changes in emotion recognition across the adult lifespan. *Soc Cogn Affect Neurosci.* 1, 1093.
- [9] Chung, K. M., Chung, E. and Lee, H. (2024). Behavioral interventions for autism spectrum disorder: A brief review and guidelines with a specific focus on applied behavior analysis. *J Korean Acad Child Adolesc Psychiatry.* 35(1): 29-38.
- [10] Rodden. J. (2025). How to treat autism spectrum disorder. ADDitude. Retrieved from <https://www.additudemag.com/autism-spectrum-disorder-treatments/>