Anaphylaxis and its Potential Correlation to Anxiety

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ABSTRACT

There has been an increasing trend of reported mental health issues and anaphylaxis in people over the years. The parts of the brain that trigger anxiety or anything in regards to issues similar to it, are the amygdala and mPFC. Usually, the mPFC controls and manages the amygdala. If inflamed, the roles reverse, causing the amygdala to be in charge of the mPFC instead, which research shows leads to mental health issues. This review highlights the mediators which cause inflammation in the mPFC and amygdala are connected to anaphylaxis, as well as ways to combat unwanted stress caused by anaphylaxis.

Introduction

Anxiety is associated with feelings of dread and fear. One brain region contributes to anxiety, while another helps reduce it: The amygdala and the medial prefrontal cortex (mPFC). The two regions communicate constantly, to manage and even prevent anxiety disorders (Marek et. al, 2013). Therefore, an imbalance between the two or hyperactivity specifically in the amygdala would result in increased anxiety (Gold et. al, 2016).

The mPFC is what controls how people think. Using memory and decision making, it has the ability to process emotional responses and determine the best course of action in regards to a certain place and time (Euston et. al, 2012). The Anterior Cingulate area controls and manages how people process uncomfortable situations (Palomero-Gallagher, 2018). The prelimbic cortex helps manage/ control stress, and when an individual is having an anxiety attack, helps relieve and end it (Chen et. al, 2024). The infralimbic cortex, on the other hand, suppresses unwanted behaviors and stress (Lalumiere et. al, 2022). The Medial Orbital Cortex helps regulate emotions after stress or anxiety (Coolen, 2017).

The amygdala is a part of the limbic system. While the mPFC helps regulate responses, the amygdala plays a different role: it processes what you perceive as dangerous. Therefore, when it does not function correctly, it can create disruptive feelings and symptoms, like anxiety or other mental health disorders (Hof et. al, 2021). The basolateral (with basolateral meaning it is located on the bottom of the temporal lobe) amygdala expresses behaviors linked to anxiety, helps process fear learning, and processes emotions. It is activated when a person is in an anxious state, and its activation can intensify anxiety symptoms (Gooch et. al, 2020). The central amygdala gets its name because it is the primary output center of the amygdala. It is tied to the behavioral and physiological responses to stimuli deemed fearful and stressful (Gilpin et. al, 2016). The cortical Amygdala is responsible for processing information that is directly related to smell (olfactory), and is also involved in defensive behaviors (Raam et. al, 2022). Lastly, the Medial amygdala's primary role is to process emotional and metabolic responses to emotional distress (Scott et. al, 2025). Metabolic responses to emotional distress can be triggered by an inflammation response. Therefore, some triggers that may create a metabolic response can be related to food inflammation (Hu et. al, 2022).

Anaphylaxis is often characterized as having a negative effect on the immune system. More specifically, it forces the immune system to overreact to a substance in the body that is harmless. Additionally, anaphylaxis can release many different mediators, such as histamine (McLendon et. al, 2023). Histamine, which is oftentimes stored

in mast cells and basophils, has many different receptors that it interacts with in the body, affecting how it functions both positively and negatively (Patel et. al, 2023). One receptor of histamine, H4, is connected to the brain. While there is uncertainty of its function, many studies have found expression of it in the hippocampus and amygdala (Carthy et. al, 2021).

Living With Anaphylaxis

Anaphylaxis directly affects a person's immune system in a harmful and even life-threatening way, because it may restrict a person's airway from functioning properly (Reber, et. al). However, having to deal with anaphylaxis can also affect a person's psychological behavior and mental health as well.

A person living with anaphylaxis is often forced to stay alert and cautious of foods or any allergens their bodies find as a threat. Having to constantly be aware of one's surroundings and worrying about different triggers that can set off anaphylaxis can lead to more stress and anxiety (Knibb et. al 2022). Because anaphylaxis is a life threatening and dangerous form of food allergies, it can be viewed as a traumatic experience emotionally for many patients having to deal with it (Polloni et. al, 2022). Therefore, because of the constant worry of triggers, particularly with anaphylaxis in regards to food allergies, many patients may have strict diets to prevent the threat altogether (Nilsson et. al, 2022).

While there are ways to manage anaphylaxis, there are currently no ways to cure it, leaving patients feeling helpless and vulnerable. Children with anaphylaxis are especially vulnerable, as they are often more likely to be dependent on their parents or guardian to protect them from their triggers. In addition, they are often more anxious than most children, leading them to take less risks in life than their peers. Children with anaphylaxis are susceptible to psychological distress and vulnerability, because they are still very dependent on adults. Therefore, if not educated correctly, it can lead to prolonged mental health disorders in the future (Manassis, 2011).

Changes in Brain Function

Allergic reactions have a direct correlation to specific parts of the brain that cause mental health disorders. In fact, recent studies proved that allergic inflammation can cause heightened activity in the brain, thus leading to anxiety and panic attacks.

Because of studies showing signs of expression with H4, one of histamine's receptors, there is evidence to show that when anaphylaxis releases histamine and other mediators, it may cause a negative response in the brain (Carthy et. al, 2021). In the brain, the mPFC and amygdala work together constantly in order to control and regulate emotional reactions. However, allergen inflammation can significantly alter the relationship between the two (Dehdar, 2019). Chemicals released during an allergic reaction (like the chemical histamine) can create hyperactivity in the amygdala (Provensi, 2018). This creates an inverse relationship between it and the mPFC, causing the amygdala to be in control of the mPFC and form heightened emotional stress as a result (Dehdar, 2019).

Spreading Awareness

There is a lack of awareness that a person with anaphylaxis may have a higher chance of having mental health disorders (anxiety, depression, etc.). By having an awareness and knowledge of this information, it can help manage and even prevent a person from having mental health disorders because of anaphylaxis (Knibb et. al, 2022).

A patient should be equipped with different coping strategies to combat any fears they have due to anaphylaxis. If a person suffers from constant anxiety attacks, clinicians should help and support patients by teaching them relaxation techniques. For example, a deep breathing technique called 4-7-8, can help relieve a person's anxiety (Aktas et. al, 2022). Another relaxing technique, "Box Breathing", is used to prevent hyperventilation, and may also be effective when it comes to supporting patients who suffer from panic attacks. It is also worth mentioning that these techniques should be practiced consistently when the patient is not suffering from mental health disorders at the moment, that way, when they do, they are prepared and know how to combat it (Manassis, 2011).

Because a patient dealing with anaphylaxis will have a high chance of having emotional distress, clinicians should also support patients by giving them different ways to manage their anaphylaxis, and be cautious of the distress it can cause psychologically (Knibb et. al, 2022).

Conclusion

This topic focuses on emphasizing an awareness of mental health and anaphylaxis. Implying an urgency to address/ be aware of mental health issues that can occur if a person has developed anaphylaxis. There are some limitations to this study, however. There is a lack of knowledge of histamine's H4 receptor, so it isn't definite when it comes to its purpose in the brain. It would be important to have more studies in the future on the psychological and neurological impact of anaphylaxis in patients, and more specifically, ways to prevent mediators from causing the mPFC and amygdala to become inflamed (Dehdar et. al, 2019).

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