The role of Neuroimaging studies (fMRI) in Anxiety

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Anxiety disorders are one of the most wide-spread and concerning diseases around the globe. Nowadays many people suffer from different types of anxiety disorders worldwide which decreases the quality of life and productivity significantly. (Medlovic et al) According to the WHO, almost one in thirteen individuals suffer from anxiety disorders which is quite concerning statistical proportion. Generally, anxiety is a natural feeling of human beings, is a typical reaction to danger, the body's automatic fight-or-flight response that is triggered when one feels threatened, but it becomes a disorder when it hurts, disturbs or leads to suffering.

Over the past years, numerous neuroimaging studies have been carried out specially dedicated to the progress of understanding the neural circuitry of anxiety disorders (Bremner 2004). Therefore, more recently, the main focus on the diagnosis of anxiety disorders has been the usage of neuroimaging techniques that will be further discussed in more detail.

fMRI- The functional brain imaging technique

The functional brain imaging technique (fMRI) allows us to be able to identify the areas in the brain circuits, where different types of neuroimaging techniques can be used, such as EEG, fMRI, PET, and SPECT. One of the most common magnetic neuroimaging techniques used is fMRI, because it is considered as an ongoing important tool in terms of imaging brain and its changes in the brain during anxiety or anxiety-related disorder. The main and useful aspects of fMRI were first explained to science in 1991 by John Belliveau. (Athinoula A. Martinos Center for Biomedical Imaging). Although there are some methods available for performing fMRI, the most used and very beneficial one is BOLD fMRI (blood oxygenation level-dependent) which allows investigators to observe the hemodynamic responses to neural firing. BOLD fMRI is a very easy method because no intravenous intervention is required.

Neuroimaging on Post-traumatic stress disorders

One of the most investigated studies in the field of neuroimaging regarding anxiety has been post-traumatic stress disorders (PTSD). PTSD is one of wide-spread anxiety disorder that is caused by having a stressful condition which can lead to a serious injury or even death. In 2006 Etkin and his colleague (Etkin et al) used fMRI to search for evidence for neural changes in PTSD. The study revealed abnormal activation in certain brain parts including the amygdala and insula which involved anxiety. Then they compared obtained neuroimaging results with other studies conducted on healthy people. The first study on PTSD has revealed activation in the amygdala, hippocampal gyrus, insula, inferior parietal lobule, mid-cingulate, and precuneus. The second study on healthy individuals regarding fear conditioning also showed amygdalar activation, as well as activity in insula.

As we can see from Etkin's study and almost all anxiety experts have always been suggested that there is an amygdalar hyperactivation in anxiety disorders. However, Etkin's neuroimaging studies proved that amygdalar activation is also observed in healthy subjects during fear conditioning. This means that when the amygdala gets activated in PTSD, SAD (social anxiety disorder), at the same time specific phobia reflects an exaggeration of the fear cycle, which leads to common symptoms among all anxiety disorders.

Neuroimaging on generalized anxiety disorder (GAD)

One of the aims of current fMRI studies is to study anxiety on generalized anxiety disorder (GAD) in particularly on specific brain areas which get activated during immediate threat condition. Recently, some investigations have highlighted peculiar abnormalities of the brain functions that underline emotional disorders in GAD patients. (Strawn et al)As a result of studies, researchers have revealed that when there is damage or disruption of functionality of the amygdala, or prefrontal cortex this can lead to anxiety. Looking from the etiological side of GAD we can see that the connection between the amygdala and prefrontal lobe can be a very important tool for investigators in order to study GAD.

Most investigators focus on a comparison between healthy and ill subjects in terms of studying GAD. For example, one of the studies among healthy and ill subjects (Christine at al) investigators revealed a noticeable activation pattern to threaten when comparing neutral pictures. Activation was observed in the cingulate cortex, dorsal anterior insula, and frontal operculum and posterior dorsolateral prefrontal cortex (Christine et al). More recently another study was conducted (Wen-jing Liu et al 2015) to observe activation of brain parts in GAD but in a resting-State fMRI session. The study was conducted with 26 teenagers with GAD. According to the findings, investigators revealed that there is an association between disruption of the amygdala with brain regions such as the cortex and subcortical parts during the resting state of the fMRI session. They found out that in the resting state, GAD patients presented decreased amygdala interconnection with the prefrontal cortex. Unlike the prefrontal cortex, an increased amygdala connection was observed with the insula, cerebellum, striatum and temporal gyros in the resting state. Based on the study researchers assumed that the disrupted functional connection of the amygdala with related brain regions may be a neuroethological map of GAD patients.

Conclusion: Up to now, several neuroimaging studies have been conducted in order to study anxiety and anxiety disorders. All these investigations have provided a better understanding of the pathophysiological mechanisms involved in anxiety by suggesting abnormal alterations in certain brain regions within the prefrontal-limbic network, including the amygdala, and insula. As a result, these studies strengthen a modular model for anxiety symptoms.Therefore, it is hoped that all efforts and future expected improvements in neuroimaging methods will support the statement that anxiety disorders will improve on the field of the initial diagnosis process and it would help with prevention in the early stage of anxiety by focusing on changes in

responsible brain areas.(Leah .et al)

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