Schizophrenia & Schizophrenic Psychosis in Early Unset and Adult Patients: A Selective Systematic Review of Structural and Functional Abnormalities for Future Understanding of Causal Effect

Yas Knegt

Department of Obstetrics and Gynaecology, Leiden Medical Faculty, Leiden University Medical Centre, The Netherlands

Corresponding Author*

Yas Knegt
Leiden Medical Faculty,
Leiden University Medical Center, Female Cancer Foundation;
Department of Obstetrics and Gynecology, The Netherlands
E-mail: ykknegt@gmail.com
Tel: + 317890765434

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Introduction

Schizophrenia is a debilitating disease. In recent years schizophrenia has become known to affect more than just one region of the brain in one way, bringing disruptions in brain chemistry, but also, alterations in brain structure, functionality, and micro and macro structural alterations, as well as decreased neural mass, abnormal brain network organizations. Schizophrenia not only affects the brain most through auditory verbal hallucinations, due to lateralization of temporoorbital language areas; cortical and subcortical volume loss and enlarged ventricles are well characterized structural brain abnormalities amongst patients with schizophrenia. All these particular changes have to be classified and compared by way of met analyses to gain a clear understanding of how the disease affects the brain all together. For this first, a literature study was done to gain understanding of the content of the available research online:

With Schizophrenia, there is evidence for structural abnormalities including both volume reductions, gray and white matter, and disturbances of normal asymmetries. Further research is necessary to understand how Schizophrenia affecting the brain, has structural consequence on the brain regions; to be able to have a clear map of the brains structural, functional and anatomical changes due to schizophrenia, and to better identify the difference between these abnormalities that can occur in different psychological conditions, in order to have a better understanding of the development of disease in each individual patient and a better course of treatment based on individual brain manifestation in patients, in the future, not only in Schizophrenia but in diseases such as ADHD and bipolar disorders.

Schizophrenia is a serious disorder that is found in roughly 0.7 percent of people at some time in their lives. it accounts for a higher percentage of the inpatient population of mental hospitals than do disorders in any other diagnostic category. It usually first manifests itself in late adolescence or early adulthood. The person must manifest for at least 1 month, two or more of the following categories of symptoms: disorganized thought and speech, hallucinations, grossly disorganized or catatonic behavior, delusions, and negative symptoms. Schizophrenia is both caused by disruptions in brain chemistry as well as alterations in brain structure- the role of glutamate in schizophrenia as well as the simple form of dopamine theory are both theories on brain chemistry alterations.

Concerning brain structure, studies using brain imaging techniques have shown structural differences between the brains of people with schizophrenia and those of other people. Decreased neural mass has been found in various parts of the brain, especially the hippocampus (involved in memory) and the prefrontal cortex (involved in conscious control of behaviors and thought. These size differences are relatively small and vary from person to person; which can be used in future treatment evaluation and individual diagnostics of patients.

Schizophrenia is associated with an increased right and reduced left temporal cortical response to auditory perception of speech, with little distinction between patients who differ in their vulnerability to hallucinations. The auditory hallucinatory state is associated with reduced activity in temporal cortical regions that overlap with those that normally process external speech, possibly because of competition for common neurophysiological resources. The most common finding so far has been enlargement of the cerebral ventricles, accompanied by a reduction in neural tissue surrounding the ventricles.

We have to take the brain as a whole with the aim to categorize the different abnormalities be it structural or functional within the different regions so as to get a clear view of all the regions involved. Regions of concern were amongst others hippocampus, corpus callosum, ventricles, hypothalamus, thalamus and frontal and prefrontal regions and cortex, and last medulla oblongata and pons:

One of the actual structural changes is volume loss in many aspects, in the brain, but also volume increase, such as the increase of the pituitary.

We found the gray matter to be the all-encompassing point of return, when it came to volume change throughout all the regions, with white matter decrease, which involves functional changes of the brain (with functional blood flow etc), and brain structural changes all found throughout literature.

Discussion

Schizophrenia is a debilitating mental disorder accompanied by abnormalities in structural brain connectivity.

A study on ventricular volumes across stages of schizophrenia and other psychoses showed that there is a significant ventricular enlargement of 36.2% in established schizophrenia but is not a feature at the earliest stages of illness (ultra-high-risk for psychosis and first-episode psychosis). Further research is needed to fully characterize the nature and timing of ventricular volume changes early in the course of illness and how these changes impact outcomes.

A study on schizophrenia showed variation in fourteen brain structure volumes by way of metanalyses of 246 studies on intracranial volume, total brain volume, lateral ventricles, third ventricle, total gray matter, frontal gray matter, prefrontal gray matter, temporal gray matter, superior temporal gyrus gray matter, planum temporal, hippocampus, fusiform gyrus, insula; and a control structure caudate nucleus. No significant differences in variability in cortical/subcortical volumes were detected in schizophrenia relative to controls. In contrast, increased variability was found in schizophrenia compared to controls for intracranial and especially lateral and third ventricle volumes. These findings highlight the need for more attention to ventricles and detailed analyses of brain volume distributions to better elucidate the pathophysiology of schizophrenia. However, schizophrenia does not only consist of ventricular volume enlargement:

Progressive reduction of gray matter is linked with ventricular enlargement in prodromal youth who develop psychosis. One study showed that individuals with clinical high risk who later developed full blown psychosis, showed an expansion of the ventricular system and an accelerated rate of gray matter thinning in superior and medial prefrontal cortex (PFC). Although these changes are well known in Schizophrenia, this particular study showed that they are linked in time prior to unset of psychosis; gray matter thinning in relation to psychosis risk are not limited to the PFC regions but also extent to other cortical regions previously implicated in schizophrenia.

Higher BMI, more residual symptoms, and inflammatory activity in IL-2 and IL-1 systems may play a role in gray matter loss in various brain regions of schizophrenia across the life span. Gray matter volume decrease distinguishes schizophrenia from other disease offspring (bipolar) during childhood and adolescence. A comparative study between offspring of patients with schizophrenia and bipolar disorder suggests that gray matter volume reduction in childhood and adolescence may be specific to offspring of patients with schizophrenia, this may index a greater neurodevelopmental impact of risk for schizophrenia and shows that the gray matter reduction matters significantly.

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