

Neuropsychological Testing of Temporal lobe Function in Persons with schizophrenia

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Abstract

Individuals with schizophrenia present with many challenges due to alterations in brain function. Temporal lobe functions, as indicated by results in neuropsychological testing, reveals a multifaceted disorder with evidence of impairment in emotional recognition, memory and agnosia in the backdrop of auditory hallucinations. The impact of functional impairment in higher order cognitive processing ultimately influences prognosis and societal integration. The following discussion will briefly examine the suitability of the Penn Emotion Recognition Test (PERT), the Dichotic Listening Test, the Wechsler Memory Scale Test, and the Graded Naming Test as appropriate tests for assessment of specific deficits individuals with schizophrenia may experience.

Keywords: Neuropsychological testing; Penn Emotion Recognition Test; Dichotic Listening Test; Wechsler Memory Scale Test; Graded Naming Test

Introduction

Schizophrenia is a mental disease characterized by significant functional impairment. [1]. Temporal lobe abnormalities have been implicated in many symptoms experienced by individuals with schizophrenia. Individuals with schizophrenia exhibit impaired facial emotion recognition, altered episodic memory, auditory hallucinations, and associative agnosia all functions of the temporal lobe.

Facial Emotion Recognition

Schizophrenia is associated with an impaired ability to accurately recognize emotions portrayed by the facial expressions of others [3-7]. Impaired facial emotion recognition is especially prominent in those experiencing positive symptoms of schizophrenia such as hallucinations, delusions, and paranoid ideation [4-7]. The PERT is composed of 40 items consisting of images of facial expressions accompanied by a list of five options (happy, sad, anger, fear, and no emotion/neutral) from which the participant must select the answer that best corresponds to the emotion being portrayed in the image [6]. There are eight images of each of the four emotions included (happy, sad, anger, and fear) and eight images of neutral faces [6]. The order in which the images appear is randomized, and the test is not timed [6]. When assessed with the Penn Emotion Recognition Test (PERT), individuals with schizophrenia punctuated with paranoid delusions are more likely to misinterpret neutral faces as angry [4]. Poor performance on tests of facial

emotion recognition such as the PERT by those with schizophrenia has been hypothesized to be due to abnormal amygdala activity [3-7]. The amygdala

is responsible for interpreting the social significance of facial expressions [8, 9]. It is theorized that symptoms of schizophrenia, especially positive symptoms such as acute paranoia, affect amygdala activity resulting in the interpretation of ambiguous, neutral faces as threatening [3-7].

Episodic Memory

Episodic memory relies on hippocampal processing. Interestingly, in schizophrenia both hippocampal abnormalities and episodic memory deficits are apparent [10]. Deficits in episodic memory are present in schizophrenia prior to psychotic episodes [10]. Functional neuroimaging has established a correlation between hippocampal dysfunction and poor performance on memory tasks in schizophrenia [10]. PET scans reveal reduced hippocampal activity in the brains of individuals with schizophrenia relative to control subjects during word recall tasks [11]. With the use of functional MR imaging increased activation of the left anterior hippocampus during encoding and greater activation in the hippocampus bilaterally during word recognition was evident in control subjects relative to individuals with schizophrenia [12].

Schizophrenia is associated with deficits in both verbal and visual/spatial episodic memory [14]. The deficits of both verbal and visual/spatial episodic memory are correlated with reduced hippocampal volume, altered shape of

the normal hippocampi, as well as cortical volume loss and thinning in the parahippocampal gyrus [14]. Left hippocampal volumes were reduced in schizophrenia relative to healthy controls [14]. Ultimately, individuals with schizophrenia generally perform poorly on memory performance tasks [14]. It is unclear at this juncture if there is a causal relationship with reported reductions in left hemisphere medial temporal lobe volumes and memory performance [13].

The Wechsler Memory Scale Revised Logical Memory I and II tests and Visual Reproduction I (VR I) and II (VR III) subtests were used to examine episodic memory [10]. The Logical Memory I and II tests, which were used to evaluate immediate and delayed verbal memory, indicated strong positive correlations between hippocampus size and performance on the episodic memory tests in healthy controls [10]. Individuals with schizophrenia were found to have a smaller hippocampal volume, albeit specific to bilateral anterior hippocampal volumes [10]. The Visual Reproduction I and II subtests were not correlated with hippocampal volume in healthy controls [10]. A positive correlation was found with bilateral posterior hippocampal volumes and performance on the VR I and VR II amongst individuals with schizophrenia [10]. It appears that hippocampus organization underlying episodic memory differs greatly amongst individuals with schizophrenia and healthy controls [10].

Auditory Hallucinations

Auditory hallucinations are one of the most notable symptoms of schizophrenia, with roughly 80% of individuals experiencing auditory hallucinations compared to only 4-5% of healthy control subjects [15]. Auditory hallucinations in schizophrenia tend to present in the form of voices that are often hostile or paranoid in nature [15, 16]. Auditory hallucinations are believed to be internally generated speech misrepresentations [15]. Structural and functional MRIs have been employed to elucidate the origin of auditory hallucinations to the left hemisphere language centre of the brain, located in the temporal lobe [15]. Due to the lateralization of the auditory pathway, Dichotic Listening Tests are useful for assessing auditory hallucinations [16, 17]. Dichotic Listening Tests expose an individual to simultaneous stimuli in both ears and ask individuals to report what they are hearing [15]. In dichotic testing, individuals with schizophrenia tend to display a reduced right ear advantage and a general difficulty in interpreting external speech. Data supports the theory that auditory hallucinations result from dysfunctional auditory processing [15]. In addition to assessing auditory processing deficits, the Dichotic Listening Test can also be used to train individuals to identify and distinguish real voices from auditory hallucinations [15].

Temporal Lobe Agnosia

Individuals with schizophrenia are more likely to experience object agnosia, where they cannot identify or name objects. Lesions in the left inferior, medial temporo-occipital lobes [19], or in Brodmann's Area 37 [20], are associated with object agnosia. The Graded Naming Test is used to identify associate temporal agnosia. Individuals are shown several images of different objects and asked to identify the objects. Gabrovskaja [21], and his team administered several neuropsychological tests to 41 individuals with schizophrenia. The individuals with schizophrenia performed most poorly on The Graded Naming Test [21], perhaps indicative of impairment of temporal lobe function and resultant deficit in the visual object recognition process.

Conclusion

Neuropsychological testing reveal that impaired facial emotional recognition, impaired episodic memory, auditory hallucinations, and associative agnosia may be specific temporal lobe dysfunctions that accompany the plethora of symptoms associated with schizophrenia.

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