Preserved emotional memory modulation in first episode psychosis

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A R T I C L E  I N F O

Article history:
Received 22 January 2014
Received in revised form 5 January 2015
Accepted 10 January 2015
Available online 15 January 2015

Keywords:
Schizophrenia
First episode psychosis
Verbal memory
Visual memory
Long-term memory
Short-term memory

A B S T R A C T

Although patients with schizophrenia have severe memory impairments and emotional deficits, studies investigating emotional memory modulation (EMM) in schizophrenia show contradictory results, possibly due to methodological differences and small group size. We investigated whether impaired EMM is already present in First Episode Psychosis (FEP) and whether impairments in EMM are task or stimulus dependent. Forty-five FEP and thirty-seven Healthy Control (HC) male participants matched for age performed visual and verbal short-term (immediate recall) and long-term (after 24 h recognition) memory tasks with neutral, negative and positive stimuli. On all tasks overall memory performance for FEP was significantly below that of HC. Although EMM varied by task and type of stimulus, none of the tasks showed a difference in EMM between FEP and HC. There were no differences between FEP and HC in the way emotion modulates different memory domains. This could mean that EMM is spared in the early course of schizophrenia.

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1. Introduction

Memory deterioration and emotional disturbances have been recognized as core features of schizophrenia since the early descriptions of the disease (Bleuler, 1916). More recent meta-analyses confirmed these impairments in both overall memory (Aleman et al., 1999; Mesholam-Gately et al., 2009) and emotional domains (Marwick and Hall, 2008) in patients with schizophrenia. In Healthy Controls (HC) memory is facilitated by emotional compared to neutral stimuli when using words, pictures or faces as stimuli (Kensinger and Corkin, 2003; LaBar and Cabeza, 2006; Kohler et al., 2010). It has been suggested that in schizophrenia there are disturbances in the effective integration of emotion and cognition (Herbener et al., 2008; Becerril and Barch, 2011). Anticevic and Corlett (2012) argue that cognitive and emotional impairments not only interact, but at the neural level share important pathophysiological features, such that disruptions caused by schizophrenia can affect both processes and the interaction between these processes (Anticevic and Corlett, 2012).

Consolidation is a key mechanism for memory formation. It entails the transformation of the initially fragile state of memories into stable, retrievable memory traces (McGaugh, 2000). On the psychological level the formation of memory can be described as the sequence of an event, the encoding of the event, the consolidation of the encoded event and by that the fixation of a memory which can be retrieved later on (Nadel et al., 2012). On the cellular level the process of consolidation seems to be based on long-term potentiation in the hippocampus and the subsequent induction of protein synthesis (McGaugh, 2000). Consolidation is a time-dependent process and the results of many different experiments suggest that sleep has an important role in successful memory consolidation (Mednick et al., 2011). Animal and human research indicates that emotionally significant experiences activate hormonal and brain systems that regulate the consolidation of newly acquired memories (Roozendaal and McGaugh, 2011; McReynolds and McIntyre, 2012). Anatomical research has detected that the amygdala, a key structure of emotional processing, influences the hippocampus, a key structure of memory formation through efferent projections deriving from the basolateral amygdala to the dentate gyrus of the hippocampus. Excitatory activity of these projection increase the amount and duration of long-term potentiation (Frey and Morris, 1997) and dendritic

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http://dx.doi.org/10.1016/j.psychres.2015.01.006
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Several studies have investigated emotional memory modulation (EMM) in patients with schizophrenia. Although two thirds of studies investigating EMM found no differences in EMM between patients with schizophrenia and HC, the remaining studies provide clues that EMM in schizophrenia is affected differently in short (STM) and long-term memory (LTM) (Dieleman and Roder, 2013). In patients with schizophrenia disturbances in EMM are found three times more often in tasks investigating LTM (Calev and Edelist, 1993; Hall et al., 2007; Herbener et al., 2007) then in tasks examining STM (Koh et al., 1976, 1981; Neumann et al., 2007; Lakis et al., 2011). Since consolidation is the main difference between short and long-term memory tasks, this suggests that an important problem with EMM in schizophrenia lies at the level of consolidation, similar to the disturbances in non-emotional memory found in schizophrenia (Manoach and Stickgold, 2009).

Studies investigating EMM in schizophrenia mostly consist of chronic patients of both genders. However, it has been shown that memory for emotional stimuli differs between men and women (Glaser et al., 2012) and this is accompanied by differences in brain processes as revealed by event-related potentials (Glaser et al., 2012). Several studies have shown that memory for emotional stimuli is influenced by the menstrual cycle (Nielsen et al., 2013) or the use of oral contraceptives (Nielsen et al., 2011). Neuroimaging findings have elucidated that during encoding of emotionally charged stimuli men have a stronger activation of the right and women of the left amygdala (Canli et al., 2002; Cahill et al., 2004). Age at onset in schizophrenia is usually later in women than in men (van der Werf et al., 2012) and both age (Addis et al., 2010) and gender (Tsaï et al., 2012) influence memory performance. To reduce confounding influences we decided to investigate only male First Episode Psychosis patients (FEP).

There is some evidence that memory impairments are related to psychopathology (Lyasker et al., 2000), but numerous studies found no relation between disturbances in EMM and psychopathology of patients (Dieleman and Roder, 2013). Impairments in EMM in both the visual (Hall et al., 2007; Herbener et al., 2007; Neumann et al., 2007; Lakis et al., 2011) and verbal (Koh et al., 1976, 1981; Calev and Edelist, 1993) domains are reported, however there are no studies comparing these two types of stimuli for both STM and LTM within the same sample.

The aim of our study was to investigate three different aspects of EMM in patients with schizophrenia, 1) whether impairments in EMM are present in FEP, 2) are possible impairments differently present in long or short-term memory, 3) are possible impairments differently present in the verbal or visual domain. To answer these questions, we tested long and short-term visual and verbal memory in a group of male FEP and compared their performance to age and gender matched HC.

### Table 1: Demographic and clinical data of participants.

<table>
<thead>
<tr>
<th></th>
<th>First Episode Psychosis patients (S.D.)</th>
<th>Healthy Controls (S.D.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>45</td>
<td>37</td>
</tr>
<tr>
<td>Age (years)**</td>
<td>23.3 (4.0)</td>
<td>23.1 (4.3)</td>
</tr>
<tr>
<td>Education (years) ***</td>
<td>7.3 (1.6)</td>
<td>8.7 (1.6)</td>
</tr>
<tr>
<td>DART IQ**</td>
<td>93.44 (8.6)</td>
<td>101.8 (8.5)</td>
</tr>
<tr>
<td>Raven IQ**</td>
<td>102.1 (17.2)</td>
<td>115.1 (18.9)</td>
</tr>
<tr>
<td>SWN**</td>
<td>83.3 (15.7)</td>
<td>96.5 (10.1)</td>
</tr>
<tr>
<td>PANSS total</td>
<td>58.5 (15.0)</td>
<td>39.2 (11.8)</td>
</tr>
<tr>
<td>SANS</td>
<td>39.2 (11.8)</td>
<td>39.2 (11.8)</td>
</tr>
<tr>
<td>SAPS</td>
<td>18.2 (15.5)</td>
<td>18.2 (15.5)</td>
</tr>
<tr>
<td>Chlorpromazine equivalents (n = 34)</td>
<td>263 (168)</td>
<td>263 (168)</td>
</tr>
</tbody>
</table>
| Duration off illness (months) | 14.8 (16.9)                           | differences were calculated using independent sample t-tests: n.s. not significant. **p < 0.01. ***p < 0.001.
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