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Review article

Theory of mind in major depressive disorder: A meta-analysis

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ABSTRACT

Objective: Social cognitive deficits can contribute to risk for depression and to psychosocial impairment during depression. However, available evidence suggests that emotion recognition is only marginally impaired in major depressive disorder (MDD). Recent studies have investigated theory of mind (ToM) abilities, a cognitively more demanding aspect of social cognition.
Methods: We conducted a meta-analysis of studies comparing ToM abilities in MDD and healthy controls. 18 studies comparing 613 patients with MDD and 529 healthy controls were included.
Results: MDD patients significantly underperformed healthy controls in ToM (d=0.51–0.58). ToM impairment in MDD was evident in response to different types of ToM tasks (verbal/visual and cognitive/affective and reasoning/decoding). ToM impairment was significantly related to severity of depressive symptoms.
Conclusion: Theory of mind abilities are impaired during depression and can potentially contribute to psychosocial difficulties during depression. There is a need to investigate ToM abilities in different subtypes and stages of depression, especially in remitted patients.

Contents

1. Introduction

Major depressive disorder (MDD) is the most prevalent mood disorder, is characterised by persistent and sufficiently severe low mood and/or loss of enjoyment and interest and is associated with significant suffering and functional impairment. Depressed individuals withdraw from social contacts, report less enjoyment in social interactions and as a result have fewer social contacts than non-depressed individuals (Hirschfeld et al., 2000). Social and interpersonal adversity is also a major risk for depression (Paykel, 1994), with mood and social factors operating in a bidirectional and at times amplifying manner.

There are multiple potential contributors to functional deficits during depression including severity, comorbidity, treatment response, personality, motivation, cognitive biases and severity of

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symptoms and neurocognitive difficulties. A number of studies has suggested that MDD is associated with neurocognitive impairment in multiple domains including attention and executive function (Bora et al., 2013; Lee et al., 2012; Snyder, 2013; Trivedi and Greer, 2014; Wagner et al., 2012). The severity of depressive symptoms might be associated with more pronounced cognitive difficulties (McDermott and Ebmeier, 2009). Cognitive difficulties during depression can equally negatively affect social functioning (Evans et al., 2014). Neuropsychological studies in other psychiatric disorders have suggested that social cognition is also impaired in number of these disorders including bipolar disorder, autism and schizophrenia (Bora and Pantelis, 2013; Kerr et al., 2003; Yirmiya et al., 1998). Difficulties in social cognition, including emotion recognition and theory of mind (ToM), can play important role in functional deficits in these disorders (Bora et al., 2006; Fett et al., 2011; Irani et al., 2012).

Social cognition deficits in MDD (Weightman et al., 2014), if proven to be consistently associated with depression, can be particularly relevant to social impairment in MDD as social cognition is essential for effective and adaptive interpersonal functioning and communication. Facial emotion recognition has been the most commonly investigated domain of social cognition in MDD. In a recent meta-analysis of 22 studies (Dalili et al., 2015), depression was associated with a significant but quite small impact on facial emotion recognition capacity. The effect size of this impairment is rather small (Hedges' $g=0.16$) compared to neurocognitive dysfunction during depression. During depressive episodes, most patients with MDD perform within the normal range in facial emotion recognition tasks, and emotion recognition deficits can be considered as relatively minor contributor to functional impairment in most people with depression. However, it might be argued that depression could be more strongly associated with difficulties in more complex and demanding aspects of social cognition including ToM. ToM is the ability to attribute mental states (feelings, beliefs, intentions, and desires) to others and understand and predict others' behaviour based on their mental states. ToM is a critical ability for adapting to our complex social environment.

A number of recent studies have investigated ToM deficits in MDD. However, available evidence provides contradicting findings regarding the extent of differences and a number of studies have not reported significant between-group differences between MDD and healthy controls (Bertoux et al., 2012; Kettle et al., 2008; Sarfati et al., 1999; Wilbertz et al., 2010). The number of participants in existing ToM studies has been small, and some studies are likely to be underpowered to show moderate deficits in ToM in depression. It is also not clear which particular aspects of ToM are impaired in MDD as mode (i.e., Verbal vs. Visual), content (i.e., inferring beliefs and motivations (cognitive) vs. inferring what a person is feeling (affective)) of stimuli used in ToM tasks and ToM processes (Decoding vs. Reasoning) in the previous studies are different. Another reason why an estimate of the extent of ToM impairment associated with depression might be useful is it can help to interpret findings of ToM studies in psychiatric and neurodegenerative disorders, as depression is a common co-morbidity in many of these disorders. The relationship between ToM impairment and severity of depressive symptoms and non-social cognitive impairment is equally not clear. In this meta-analysis we aimed to investigate ToM abilities in depressed MDD patients in comparison to healthy controls and to explore the relationship between ToM and variables of interest including depression severity and executive dysfunction.

2. Methods

2.1. Study selection

We followed PRISMA guidelines in conducting this meta-analysis (Moher et al., 2009). A literature search was conducted using the databases Pubmed, PsycINFO, ProQuest and Scopus to identify the relevant studies (January 1990 to August 2015) using the combination of keywords as follows: Theory of mind, mentalizing, social cognition, major depression. Reference lists of published reports were also reviewed for additional studies and Google Scholar was to retrieve unpublished material including conference paper and theses. Inclusion criteria were studies that: (1) compared ToM performances of MDD including chronic depression (DSM-III-R or DSM-IV criteria) and healthy controls; and (2) reported sufficient data to calculate the effect size and standard error of the social cognition measure. Studies whose samples overlap with included studies (3 studies) and one study that investigated ToM in patients with oesophageal cancer and depression were excluded. We also excluded two studies that investigated ToM in remitted MDD. The reason for this decision was to avoid introducing heterogeneity which cannot be further explored due to the very limited number of remission studies. We contacted two authors of papers that did not report sufficient data to calculate effect sizes but were unable to ascertain this data.

Eighteen studies involving 613 MDD patients (63.8% females) and 529 healthy controls (58.8% females) were included (Table 1) (see figure in appendix for flow chart of the study selection process). There was no significant between-group difference for gender (RR=1.05, CI=0.95–1.15, $Z=0.91$, $p=0.36$) and age ($d=0.08$, CI= −0.10 to 0.26, $Z=0.89$, $p=0.37$). Fig. 1

2.2. Social cognition measures

Studies used different ToM tasks including faux pas recognition, Reading the Mind in the Eyes Task (RMET), picture sequencing tasks, Movie for the assessment of social cognition (MASC), TASIT (The Awareness of Social Inference Test)-sarcasm and different versions of false belief and ToM stories and ToM cartoons (Baron-Cohen et al., 2001; Dziobek et al., 2006; McDonald et al., 2006; Stone et al., 1998).

2.3. Statistical analyses

For studies that reported more than one ToM task, pooled effect size and standard error values were calculated. Other than total ToM score, separate effect sizes for content ("cognitive" and "affective") and mode ("verbal" and "visual") and process ("decoding" and "reasoning") ToM scores were calculated. Affective ToM assessment was based on tasks (RMET, some items of MASC and affective false belief cartoons (Mattern et al., 2015)) that require recognition of emotional reactions. It was also possible to calculate scores for one individual ToM task as relatively larger number of studies has used this task (RMET) and RMET was also the only mental state decoding task used in the studies included in the current meta-analysis.

Meta-analyses were performed using packages in R environment (OpenMetaAnalyst, Metafor) and MIX software version 1.7 on a Windows platform (Bax et al., 2006; Viechtbauer, 2010; Wallace et al., 2012). Effect sizes were weighted using the inverse variance method. A random effects model (DerSimonian–Laird estimate) was used as the distributions of effect sizes were heterogeneous for the number of variables. Homogeneity of the distribution of weighted effect sizes were tested with the I^2 and Q-tests. Tau squared (τ^2), an estimate of between study variance, was used as a measure of heterogeneity in the random effects model.