



When Thoughts Are in a Race: Area 10 and Bipolar Disorders

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Racing thought, when patients incessantly shift from one word or sentence to another while pending previous ones unfinished, is a symptom of (hypo)mania in bipolar disorders received less attention hitherto. Here, based on few evidence, we aim to unfold our hypothetical viewpoint that the frontopolar cortex that is believed to play a part in multitasking and management of competing goals might be dysfunctional in bipolar patients and may contribute in induction of flight of ideas. We then address new avenues for future research and try to encourage researchers to design more comprehensive studies to either accept or decline this proposed conjecture.

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Key Words Frontopolar cortex, Area 10, Bipolar disorders, Flight of ideas, Racing thought, fMRI.

VIEWPOINT AND HYPOTHESIS

What we surmise here is that it might be a liaison between the emergence of flight of ideas and the dysfunction of the most anterior part of the frontal cortex known as the frontopolar prefrontal cortex (Brodmann's area 10) or the rostral/anterior prefrontal cortex.

SCENARIO

Bipolar disorder (BD) is a mercurial disorder of mood that exhibits fluctuations between depression, euthymia, and (hypo)mania with current prevalence of less than 1%. These worlds apart mood statuses are the cornerstone for diagnosis of BD and are characterized in terms of energy or activity, emotion, thought, mood, and functionality.¹⁻³ Decreased need for sleep, inflated self-esteem, increased energy and goal directed activities, distractibility, flight of ideas, and pressured speech as well as elevated, expansive, and irritable mood/behavior are the hallmarks of (hypo)manic episode^{1,3} among which flight of ideas is the focus of this viewpoint.

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Flight of ideas, a disturbance in flow of thought, is a component of thought processing disorder in which an individual is swiftly switching between thoughts in a highly associative manner with a logical connection between two sequentially expressed ideas so that the fundamental theme of the speech cannot be preserved long enough. This experience is subjectively alluded by patients as if thoughts are racing from each other. Springing from one topic or word to another, which may sometimes be arisen from intertwined and linked cues, that finally might result in an incoherent and incomprehensible speech to the listeners even though the normal association of thought is still conserved.^{4,5}

Though frontopolar cortex has received great attention during the past decade, the pinpoint function of it is still equivocal and under rigorous investigation. Frontopolar cortex is inordinately large in humans and neuroimaging studies have corroborated that it is linked to supramodal areas of the prefrontal cortex as well as anterior temporal areas.⁶⁻⁸

EVIDENCE TO RELY ON?

It is proposed that area 10 plays a pivotal role in multi-tasking; when there is either an external stimulus or an internal self-generated thought in mind, area 10 detains and postpones the currently ongoing task or thought while processing the secondary incoming one in order to prioritize the event (e.g. potential threats) and tailor to better respond to external stimuli.⁶⁻¹⁰ In other words, frontopolar cortex provides a pending state for the presently processing information to be able to shift toward a more recent goal and then retrieve back to the

temporally bygone one again, and manage event sequencing and cognitive branching. Moreover, lesion studies have suggested that the amount of damage to the area 10 is positively associated with impaired multi-tasking and prospective memory, both of which are important to enable an individual to perform an activity after a delay.⁸

On the other side of the coin, several lines of evidence have delineated that area 10 becomes dysfunctional during the course of BD. Interestingly, in an event related fMRI study, during response inhibition, euthymic bipolar patients have demonstrated noticeable less extended and diminished functional activity of the left frontopolar cortex compared to healthy subjects.¹¹ This observation might lead to the deduction that patients with BD may not properly engage frontopolar cortex for suppressing actions that are no longer required;¹¹ the same condition that is seen when thoughts are racing and patients are unable to quench impertinent thoughts and stay focused to the core point, thus, incessantly shift from one word or sentence to another while pending previous ones unfinished.

In addition, a recent neuroimaging study on youth manic bipolar patients in comparison with healthy individuals reported hypo-activity of the right frontopolar cortex that was normalized after an 8-week treatment with extended release formulation of carbamazepine.¹² Treatment with this mood stabilizer did not display significant correlation with changes of the Young Mania Rating Scale (YMRS).¹² Comparison made on the baseline activity of the area 10 in healthy subjects with the activity of this region in patients group after receiving carbamazepine, revealed no statistically significant changes in the activation of the area 10.¹²

Such evidence empowers our hypothesis that area 10 is where flight of ideas originates from, and therefore might be blunted in patients with BD. We also propose that lack of observed statistically significant correlation between YMRS and enhanced normalized activation of the area 10 might be due to the low scores assigned for language-thought disorder section of the test, which may ultimately amend 1 to 3 points of the total score. Since we postulate that impairment of the frontopolar cortex in BD might be particularly a putative contributor for generation of racing thoughts and no other associated symptoms of BD to a great extent, it is not expected to affect the YMRS greatly. Hence, this finding of Schneider et al.¹² may further vouch for our proposed hypothesis that dysfunction of the frontopolar cortex is exclusively associated with emergence of flight of ideas.

FUTURE AGENDA

Frontopolar cortex is known as a neural “bridge” to colligate

emotion and cognition. Since BD is a disorder of emotion and cognition, involvement of the area 10 in the pathophysiology of BD can be anticipated and based on its function in multi-tasking, as aforementioned, dysfunction of the frontopolar cortex may be of paramount importance in inducing racing thoughts.

The number of studies to draw on a solid conclusion is very few, and this hypothesis has been built hinged upon scant and limited available data which makes it highly speculative. However, we attempted to highlight the existing gaps and feature an essential unmet need to utilize advanced neuroimaging techniques in order to investigate whether functional activity/connectivity of the area 10 is disturbed when patients are (hypo)manic and are actively experiencing racing thoughts. Furthermore, neuroimaging studies could help other probable brain regions involved be identified and give us a more complete understanding on one of the constituents of (hypo)mania in BD. It is also highly recommended that both euthymic and (hypo)manic bipolar patients who are either medicated or medication-free be longitudinally examined to see whether possible alteration in neural correlates of the frontopolar cortex during flight of ideas is a trait feature of BD or it is state-dependent. Finally, explorations of these desiderata may shed light on developing special games and cognitive tasks to reduce the accelerated flow of thoughts toward a more coherent speech in bipolar patients.

Conflicts of Interest

The authors have no potential conflicts of interest to disclose.

Author Contributions

Conceptualization: Shokouh Arjmand. Data curation: Shokouh Arjmand. Funding acquisition: Shokouh Arjmand. Investigation: Shokouh Arjmand. Project administration: Shokouh Arjmand. Supervision: Vahid Sheibani, Abdolreza Sabahi. Validation: Vahid Sheibani, Abdolreza Sabahi. Writing—original draft: Shokouh Arjmand. Writing—review and editing: Vahid Sheibani, Abdolreza Sabahi.

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