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

Shokouh Arjmand, Abdolreza Sabahi, and Vahid Sheibani
Institute of Neuropharmacology, Kerman Neuroscience Research Center, Kerman University of Medical Sciences, Kerman, Iran

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.

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

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.

ORCID iDs

Vahid Sheibani https://orcid.org/0000-0003-4321-6103
Shokouh Arjmand https://orcid.org/0000-0002-5151-8702

REFERENCES

1. Vieta E, Berk M, Schulze TG, Calabrese JR, Gao K, Miskowiak KW, et al. Bipolar disorders. Nat Rev Dis Prim 2018;4:18008.
2. Mali GS, Berk M, Morris G, Hamilton A, Outhred T, Das P, et al. Mixed mood: the not so united states? Bipolar Disord 2017;19:242-245.
3. Arjmand S, Behzadi M, Stephens GJ, Ezzatabadipour S, Seifaddini R, Arjmand S, et al. A brain on a roller coaster: can the dopamine reward system act as a protagonist to subdue the ups and downs of bipolar disorder? Neuroscientist 2018;24:423-439.
4. Ward T, Bernier R, Mukerji C, Perszky D, McPartland JC, Johnson E, et al. Flight of Ideas. In: Volkmar FR, Editor. Encyclopedia of Autism Spectrum Disorders. New York, NY: Springer, 2013, p.1299-1300.
5. Oyebode F. Disorder of the ‘Thinking Process’. In: Sims’ Symptoms in the Mind: Textbook of Descriptive Psychopathology. 5th Ed. Edin-
6. Dreher JC, Koechlin E, Tierney M, Grafman J. Damage to the frontopolar cortex is associated with impaired multitasking. PLoS One 2008;3:e3227.
7. Burgess PW, Dumontheil I, Gilbert SJ. The gateway hypothesis of rostral prefrontal cortex (area 10) function. Trends Cogn Sci 2007;11:290-298.
8. Roca M, Torralva T, Gleichgerrcht E, Woolgar A, Thompson R, Duncan J, et al. The role of Area 10 (BA10) in human multitasking and in social cognition: a lesion study. Neuropsychologia 2011;49:3255-3231.
9. Koechlin E, Hyafil A. Anterior prefrontal function and the limits of human decision-making. Science 2007;318:594-598.
10. Mansouri FA, Koechlin E, Rosa MGP, Buckley MJ. Managing competing goals—a key role for the frontopolar cortex. Nat Rev Neurosci 2017;18:645-657.
11. Kaladjian A, Jeanningros R, Azorin JM, Nazarian B, Roth M, Mazzola-Pomietto P. Reduced brain activation in euthymic bipolar patients during response inhibition: an event-related fMRI study. Psychiatry Res 2009;173:45-51.
12. Schneider MR, Klein CC, Weber W, Bitter SM, Elliott KB, Strakowski SM, et al. The effects of carbamazepine on prefrontal activation in manic youth with bipolar disorder. Psychiatry Res 2014;223:268-270.