Cortical Thinning in Young Psychosis and Bipolar Patients Correlate with Common Neurocognitive Deficits

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Target audience: Neuroimaging researchers, psychiatrists, neuropsychologists, psychiatric researchers.

Purpose: People in mid-life with established psychosis or bipolar disorder exhibit patterns of cortical thinning across several brain regions. It is unclear whether these patterns are indicative of a continuously active pathological process, residual effects of an earlier illness phase or pre-illness onset developmental risk factors. Here, we investigated whether cortical thinning is evident in younger patients in the early phase of psychosis or bipolar disorder and the relationship between cortical thinning and neurocognitive performance in young people.

Methods: Magnetic resonance imaging (MRI) was obtained from a sample of young patients with psychosis (mean age 23.5 years), bipolar disorder (mean age 21.9 years) or controls (mean age 24.2 years). Patients underwent neurocognitive tests derived from the Cambridge Automated Neuropsychological Testing Battery (CANTAB [1,2]) including the Rapid Visual Information Processing task (RVP) to test visual sustained attention, Trail-Making Test (TMT) to assess mental flexibility, the Paired Associates Learning (PAL) to assess episodic memory and learning, and the Intra-Dimensional/ Extra-Dimensional task (IED) to test attention-set shifting. Verbal learning and verbal memory were assessed by the Rey Auditory Verbal Learning Test (RAVLT [2]) and verbal fluency was measured by the Controlled Oral Word Association Test (COWAT [2]). Age- and educational-adjusted *z*-scores were derived from normative data [3]. Group differences in cortical thickness were assessed using statistical difference maps, and regions of cortical thinning were correlated with medication dosage and performance on neurocognitive tasks.

Results: The psychosis group showed cortical thinning predominantly in the left intraparietal sulcus and angular gyrus and right superior temporal gyrus compared to controls. Conversely, the bipolar group showed cortical thinning predominantly in the left calcarine sulcus and right supramarginal gyrus, precuneus and precentral gyrus compared to controls. Contrasting the two patient cohorts, the psychosis group showed cortical thinning in the right fusiform compared to the bipolar group. Compared to the psychosis group, the bipolar group exhibited cortical thinning in the right parieto-occipical sulcus extending to the ventral posterior cingulate. While several neurocognitive domains were associated with cortical thinning in these regions, the most significant neurocognitive deficits were associated with thinning of the right supramarginal gyrus (common in both bipolar and psychosis subjects), namely worse performance in visual sustained attention (RVP mean latency, $r = 0.29$, $p = .005$), semantic verbal fluency (COWAT, $r = 0.25$, $p = .014$) and verbal learning and verbal memory (RAVLT, $r = 0.22$, $p = .028$).

Discussion: In contrast to reports of extensive cortical thinning of the temporal, frontal and insula regions in older patients with psychosis, we report that young patients with psychosis exhibit predominately parieto-temporal cortical thinning. Young patients with bipolar disorder exhibit cortical thinning in regions more consistent with those previously reported in paediatric bipolar patients[4]. Both psychosis and bipolar subjects exhibited cortical thinning in the inferior parietal lobe, comprising of the supramarginal gyrus and angular gyrus, and the adjacent intraparietal sulcus which was strongly correlated with worse performance in visual sustained attention, semantic verbal fluency, verbal learning and verbal memory. These results are consistent with the literature associating this region with language comprehension and decision-making [5], and cortical thinning of the parietal lobe has been associated with attention deficits in first-episode psychosis patients [6].

Conclusion: Given the controversial nature of the diagnosis of paediatric bipolar disorder, the actual time-course of these effects can only be determined in proper longitudinal studies. While these disorders may have differing neuropathological origins, it is these shared regions of cortical thinning that that most significantly impact the lives of young people with psychosis or bipolar disorder.

References

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