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BIPOLAR DISORDERS Factsheet

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What is diffusion tensor imaging (DTI)?

DTI is a specialised imaging technique that uses MRI technology to investigate the movement of water within tissues of interest. It is a powerful imaging method for characterising the integrity of white matter circuitry because it links anatomical and functional neuroimaging.

By applying a magnetic field, the movement ("diffusivity") of water molecules can be visualised in vivo. The diffusion of water is influenced by the cellular structure of the surrounding tissues, and measures such as fractional anisotropy were derived as an approximate measurement for the freedom of movement. In areas of high structural coherence such as white matter, FA is highest, indicating that water is moving in relatively fixed directions. It is lower in grey matter, and close to zero in cerebrospinal fluid, indicating that water is moving freely. Consequently, changes in fractional anisotropy values are interpreted to be representing alterations in the structural integrity of the regional white matter. However, as alterations in fractional anisotropy cannot be linked directly to specific tissue characteristics, such as myelination, other measures including radial diffusivity have been investigated to determine the degree of myelination.

Region-of-interest studies assess white matter integrity in individual brain regions, while voxel-based analyses assess whole brain white matter integrity. Tract-based spatial statistics isolates the central core of white matter tracts with the highest fractional anisotropy and reports significant clusters within that white matter skeleton. Three classes of white matter tracts have been identified. Commissural tracts connect the two hemispheres of the brain, association tracts connect regions within the same hemisphere, and projection tracts connect each region to other parts of the brain or spinal cord.

Understanding neurological structural alterations using DTI in people with bipolar disorder may provide insight into the molecular neurobiology of aberrant neurotransmission, by highlighting brain regions where reduced cellular integrity may contribute to symptom expression.

What is the evidence for DTI findings in people with bipolar disorder?

Moderate quality evidence finds decreased fractional anisotropy and increased radical diffusivity in the right corpus callosum, anterior thalamic radiations, fronto-orbito-polar tract, and superior longitudinal fasciculus of people with bipolar disorder compared to controls. Fractional anisotropy showed additional reductions in the right interstriatal white matter of patients, and radical diffusivity showed additional increases in the right corticospinal tract of patients. There were also decreases in white matter integrity in relatives of people with bipolar disorder compared to controls in the right corpus callosum body, left corpus callosum splenium, and the left corticospinal tract. There were similar decreases in people with bipolar disorder and people with schizophrenia in white matter integrity in the genu of the corpus callosum extending to anterior thalamic radiation/cingulum fibers/ inferior fronto-occipital fasciculus, and in left posterior cingulum fibers.

For more information see the technical table

NeuRA
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NeuRA (Neuroscience Research Australia) is one of the largest independent medical and clinical research institutes in Australia and an international leader in neurological research.

Diseases of the brain and nervous system pose the greatest health, economic and social burden of any disease group because they are chronic, debilitating and have no known cures.

Medical research is the cornerstone of efforts to advance the health and wellbeing of families and the community. Our dedicated scientists are focussed on transforming their research into significant and practical benefits for all patients.

While we hope you find this information useful, it is always important to discuss any questions about bipolar disorder or its treatment with your doctor or other health care provider.

HOW YOUR SUPPORT HELPS

We are able to make significant advances due to the generosity of countless people. Your donation allows us to continue to work towards transforming lives. For information on how you can support our research, phone **1300 888 019** or make a secure donation at **neura.edu.au**.

NeuRA (Neuroscience Research Australia) Foundation
T 1300 888 019 **F** +61 2 9399 1082
ABN 57 008 429 961

Margarete Ainsworth Building
Barker Street, Randwick NSW 2031
PO Box 1165 Randwick Sydney NSW 2031 Australia

neura.edu.au